SCIENTIFIC AMERICAN

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THE EAGLE BICYCLE.

When one stops to consider what marvelous ingenuity has been expended in the past on the problem of transportation for the masses it is truly surprising to think it should have been only of recent years that practical methods for assisting persons to cover long distances with ease and speed have been devised.

It is still more wonderful when one considers the simplicity of the piece of mechanism with which the result is accomplished—the modern light weight bicycle.

So many prominent men in all walks of life have now become devotees of the wheel that at the present time the question of individual transportation may truthfully be said to have become one of the greatest factors, not only in the development of trade, but in the increased growth of our cities and towns where good highways abound.

It is also claimed that no manufactured article is used by so many different classes of society as is the bicycle, and there certainly has been no exercise, sport or pastime which has proved more beneficial to the human race or given greater relaxation and pleasure than a spin upon the wheel.

There is far more interest shown by purchasers and riders regarding the mechanical features and methods of construction used in bicycle manufacture than in any other article made or sold to-day. If a man could acquire as much knowledge by investigation and inquiry regarding his watch as his bicycle, there would be fewer worthless watches sold.

In 1888, before the advent of the now universal type of safety bicycle, and when ordinary high bicycles were really too dangerous for use by conservative riders who desired to enjoy the delight of cycling, the Eagle high wheel appeared to be the coming wheel, as the liability of headers had been entirely eliminated by the small front or steering wheel, this result having been accomplished without the use of gears or clutches, which were then in a very crude state of advancement.

With the appearance of the safety bicycle, and immediately upon its general acceptance by the riding

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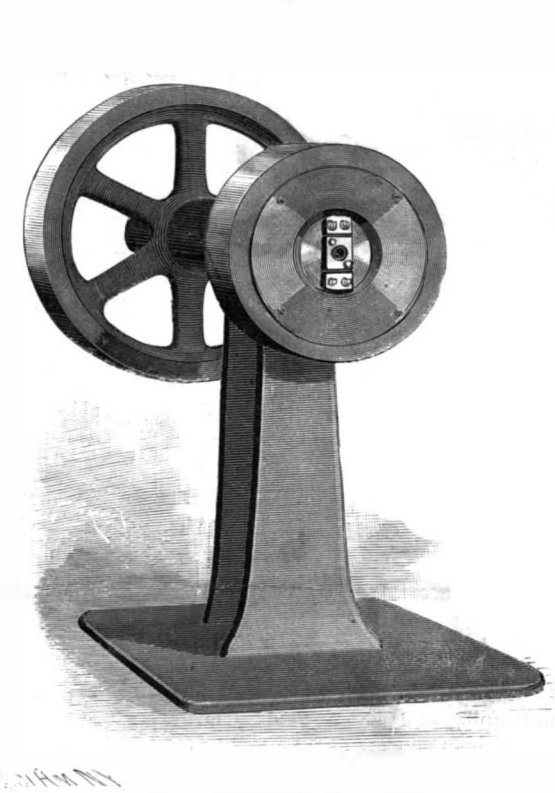

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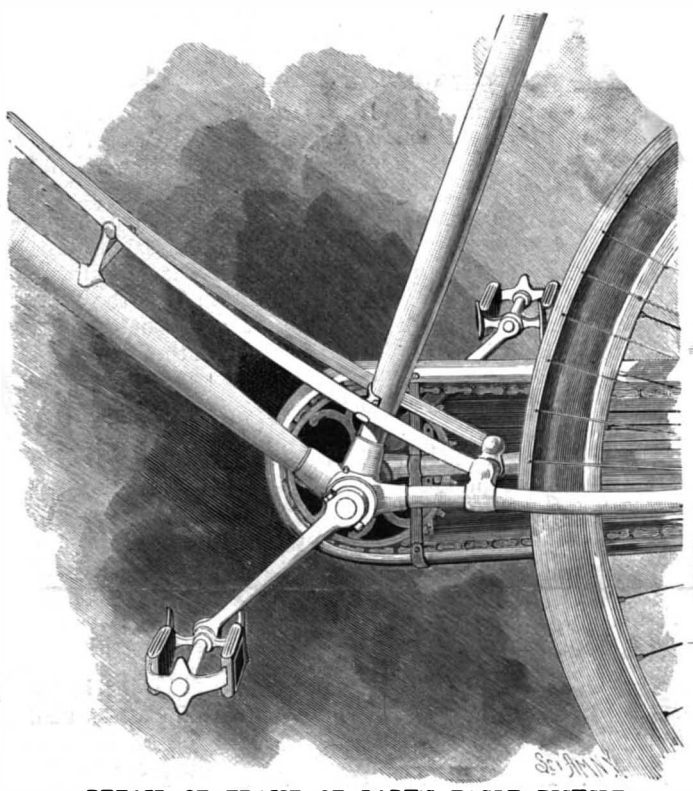

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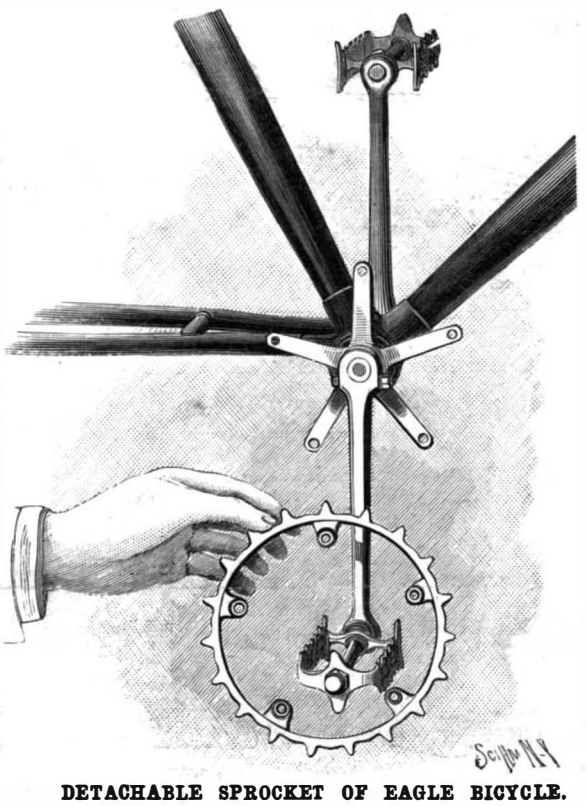

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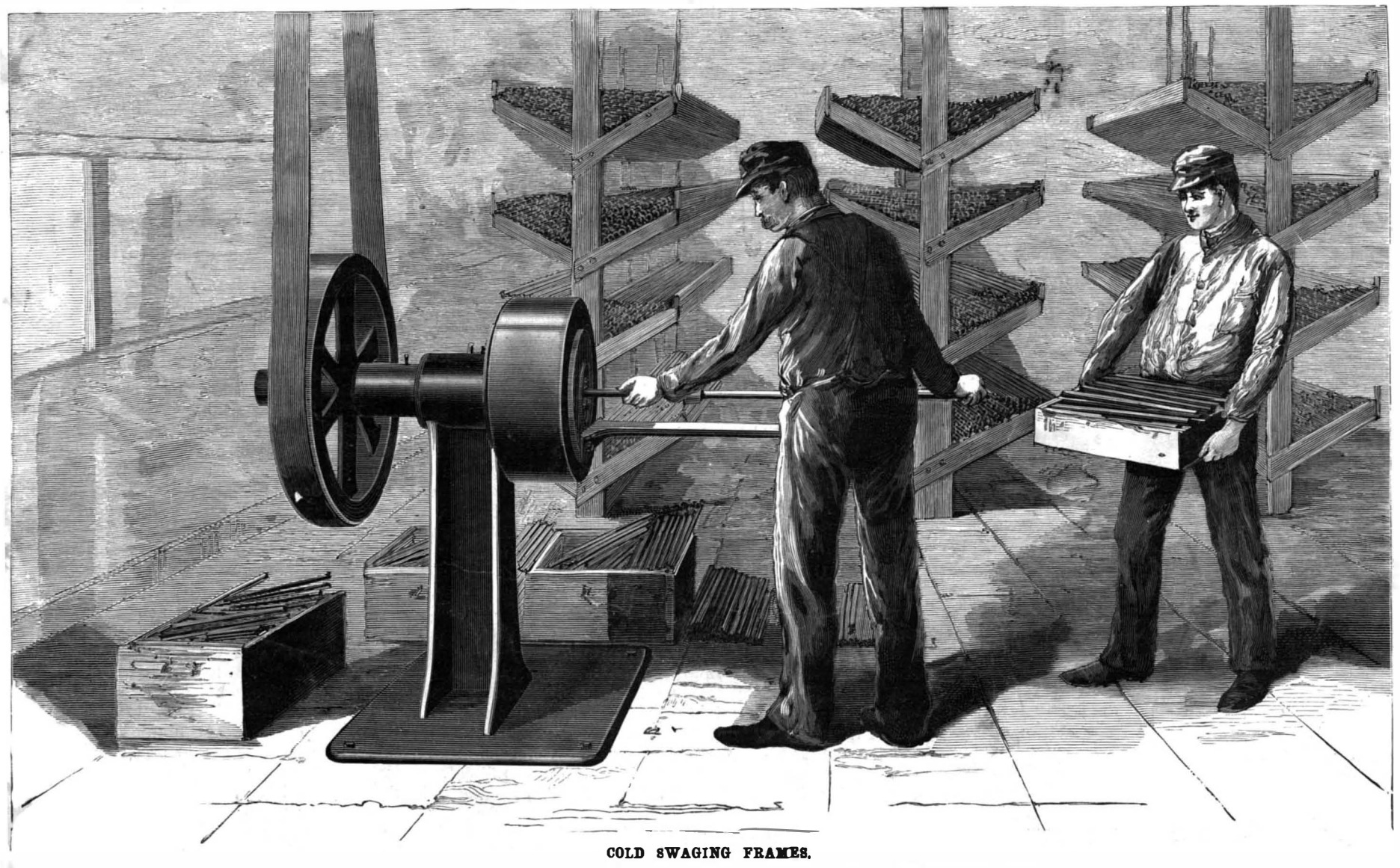

COLD SWAGING FRAMES.

THE EAGLE BICYCLE—ITS MANUFACTURE AND CONSTRUCTION.

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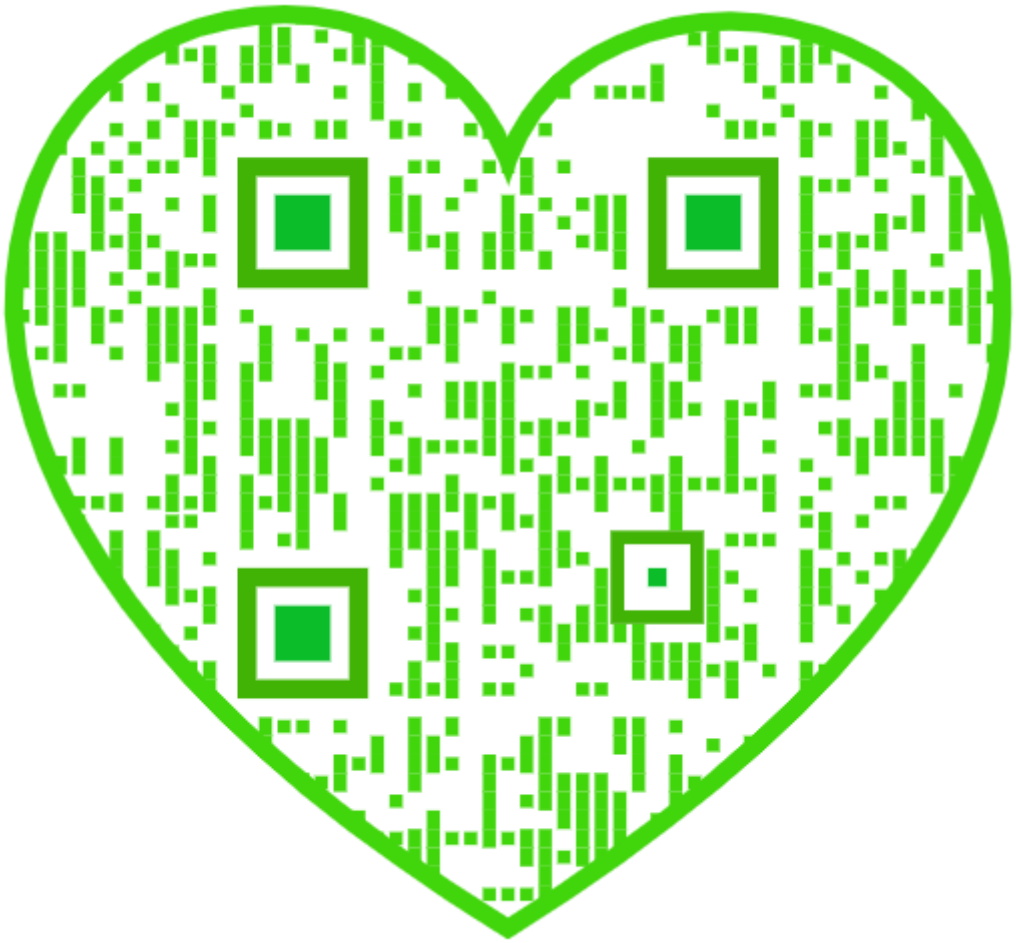

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ALFRED ELY BEACH.

When this issue of the SCIENTIFIC AMERICAN reaches our readers many of them will have already been apprised by the daily press of the death of Mr. Alfred Ely Beach, one of the members of the firm of Munn & Company, and for fifty years a leading figure in the world of science and invention. When a prominent member of a great business dies, his record in the business world is usually of ephemeral interest, in the sense that his works perish with him. But in the case of Mr. Beach it is different. In the works of his life, in his inventions—many made at so early a date as to be some decades ahead of the proper time for their development—in his services in the world of science as one of the proprietors and virtually a co-founder of the scientific publications of his firm, in the work represented by the thousands of patents procured by his firm for the inventors of America during the last fifty years—in these, his life's work is of perennial character, and his services to humanity will not soon be forgotten, while the SCIENTIFIC AMERICAN will endure as a monument of the life's work of his firm. In speaking of his death to our readers we feel that the loss is theirs as well as ours, and that among the numerous clientage of inventors who have profited by the counsels of this firm, and of scientific students who have found in the SCIENTIFIC AMERICAN their weekly pabulum, will be found an army of devoted friends and true mourners.

Alfred Ely Beach was born in 1826 in Springfield, Mass. His death occurred on January 1, 1896, from pneumonia. His father, Moses Y. Beach, was one of the prominent figures in the life of old New York. He was the founder and for many years the proprietor of the New York Sun. His son received his education at the celebrated Academy in Monson, Mass.

The Reverend Alfred Ely, a distant relative, from whom Mr. Beach was named, was the Presbyterian clergyman of the town, and Mr. Beach was placed under his guardianship. After graduation from the academy the father took his son into the Sun office, and under his father's direction he received the thorough training in the publishing business which left him so well equipped for what was to be his life work. It was a rare treat to hear Mr. Beach tell of his early experiences in the forties, when the electric telegraph was slowly coming into use, when the first railroads and steamships were making their entry into the world, and when the habits of life in old New York were less cosmopolitan than now.

In the Monson Academy, which was one of the leading educational institutions of the country, Mr. Orson D. Munn, with whom Mr. Beach has been associated for a few weeks less than half a century, had been a schoolfellow of Mr. Beach. In 1846 the two young men entered into partnership, purchasing the SCIENTIFIC AMERICAN. The paper was then but a small affair. It had been started on August 28, 1845, by Rufus Porter, a strange, many sided genius, who found room in the columns of the new journal not only for science, but for poetry, and for moral and religious items. The issue of July 23, 1846, was the first to appear with the title of the new firm of Munn & Company as proprietors, and Rufus Porter as editor.

Another interesting point is brought out by an announcement made at this early date in the columns of the new journal to the effect that patents could be secured through the SCIENTIFIC AMERICAN Patent Agency. Mr. Beach, having an inborn taste for mechanics, became at once interested in the inventors of this country and gave his best work and thought in securing for them their rights from the Patent Office.

In 1846 the profession of patent solicitors was hardly known. Most of the work in this city had been done by Mr. Sickles, the father of General Daniel Sickles, and a lawyer by the name of Seth Staples.

During the year 1846 less than 600 patents were issued. The inventors of the United States were just starting on their career which has brought about the issue of more than 20,000 letters patent annually for the past ten years.

Between the years 1850 and 1860, it was Mr. Beach's custom to go to Washington every two weeks, to personally attend to the applications pending in the Patent Office, which had been filed by Munn & Company as a firm, and no solicitor was better known at the Patent Office than he.

Later, as the business of soliciting patents assumed larger proportions, it became necessary to establish a branch office at Washington, which is still kept up with a corps of some twenty employes. The SCIENTIFIC AMERICAN meanwhile grew in size and interest, and with the patent department as an adjunct, the incesssant labor of the two partners was often prolonged far into the night, and the SCIENTIFIC AMERICAN became a unique figure in the world of journalism. It formed a complete review of the world's progress in science, its bound volumes forming semi-annual records of permanent value. It seemed desirable that much of the interesting matter which had appeared in the paper during the year should be put into book form, and in 1872 the "Science Record," an illustrated octavo volume of 590 pages, compiled mostly by Mr. Beach, was first published. The "Science Record," in addition to numerous articles and notes on science and invention, contained biographical sketches, with portraits, of noted men of science. Thus in the volume of 1873, now before us, we find a beautiful steel engraving of Professor Joseph Henry, woodcuts of Tyndall, Peirce, Dana, Morse, Kirchhoff, and Bunsen, men prominent in the world of science, and of Judge Nelson, of the Supreme Court, together with accompanying biographies.

In 1876 the publication of the "Science Record" was discontinued. The SCIENTIFIC AMERICAN SUPPLEMENT, which was started in the same year, was designed in part to take the place of the "Record," and also to illustrate the great Centennial Exhibition in Philadelphia. When the year was completed the demand for the new publication was so great that it has been continued up to the present time, and is considered by thoughtful men, who as a class are mostly its patrons, to be the most valuable scientific "current opinion" or "review of reviews" that has ever been published. Mr. Beach took a special interest in this publication, and by his energy and taste for sound reading, his selection of matter for the paper has made it popular and gained for it a very large circulation.

It is not going too far to say that the editing of the SUPPLEMENT by Mr. Beach was a labor of love. Mr. Beach was a good Spanish scholar, and the monthly edition of the SCIENTIFIC AMERICAN, published in part in that language, was established at his instance. When its circulation had reached the point where the income from it equaled the expenditure he manifested great delight. He wanted our South American republics to know what was going on in mechanics, the arts, and the sciences at the North. His fondness for new inventions always rendered him courteous to inventors, and however busy he might be, he never was reluctant to lay aside his work to greet an inventor and listen to his description of his invention, exhibiting that degree of interest which was marvelous. He enjoyed every new invention, and never tired looking after an inventor's best interest.

His regularity of attendance at the office was remarkable. He never took a vacation. Year after year would go by without his ever being absent from his desk. His extensive reading of contemporaneous matter, as well as of books of general literature, gave him, in spite of his apparent confinement, a large horizon appreciable by anyone to whom he opened his mind. There was a piquancy of thought and originality of mind about him that flavored all his utterances.

Mr. Beach was in many ways a most remarkable man, but perhaps the most conspicuous feature of his evenly balanced character was the never tiring industry with which he applied himself to the multifarious interests with which he was connected, and to the investigation of hundreds of new and interesting subjects constantly coming into the field of his researches. Although he well knew his limitations, he was never satisfied with mere superficial or cursory knowledge of a subject, but brought to each new question the closest analysis and most careful scrutiny of the facts, with a directness in all cases indicating that there was never any "lost motion," and with an amplitude of previous information suggesting Bacon's well known saying, that he had "taken all knowledge for his province." He was never impatient, never in a hurry, and always had time for everything, for his life was carefully regulated, down to the nicest details, with the idea of saving and making the best possible use of all his time. His faculty of conciseness and directness of expression, and his quick perception of the salient points of an invention submitted for his judgment, were marked characteristics of his business life.

The ever active mind was not satisfied to be busy only with the recording of other men's work. He was himself an inventor who has made a broad mark in the world of science and art. He invented, about 1853, the first typewriter, which was intended for the use of the blind, and which was awarded a gold medal at the Crystal Palace Exposition. His machine, a most elegant and expensive piece of mechanism, is still in existence, and has been fully illustrated and described in this paper. His inventions touch upon cable traction of cars and other railway inventions dating back some thirty years. Pneumatic tubes for delivery of mail matter; also the famous Beach hydraulic shield for tunneling in earth and under river beds, were inventions dating back over twenty years. The first successful use of the shield was in the construction of the experimental tunnel under Broadway, between Warren and Murray Streets, in 1869, while one of the latest noteworthy examples of its use was the construction, in 1890, of a large railway tunnel between the United States and Canada under the St. Clair River at Port Huron, Mich. Mr. Beach was twenty years in advance of his time, and his inventions have acquired their fruition two or more decades after he originated them.

Mr. Beach's private life was characteristic of his

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strong and individual personality. For society, as such, he had no taste, but all his time, away from the office, was passed at home, among his family, where, as husband and father, and always as closest friend, his gentleness, his sympathy, his ever thoughtful attention to the comfort and happiness of those dependent upon him, afforded evidence that here only did he seek the happiness of life, except such as was afforded by the satisfaction with which he successfully pursued his intellectual labors.

His personal habits were of the simplest and most regular description. He believed that good health depended upon regular habits, simple life, early hours, and regular and systematic exercise; and, although Mr. Beach was an unusually hard worker, he scarcely ever during his life had an illness until his last. He had a great love of music, and the opera was his only dissipation.

Mr. Beach was an ardent admirer of the Rev. Henry Ward Beecher, and he desired to become a parishioner, but the distance between his house in New York and Plymouth Church, Brooklyn, was so great that this became impracticable. With the consent of Mr. Beecher, a private telephone wire was introduced into the church, with a transmitter attached to the pulpit, the result being that Mr. Beach could attend divine service without leaving his own home.

He greatly enjoyed asking his friends to his house during the early days of the telephone, to listen to the eloquent preacher. When the hymns were announced hymn books would be handed about, and the little parlor congregation could join in the songs of praise with the audience several miles away.

Mr. Beach's family consists of a widow, one son, and a daughter, who mourn his loss. Since Mr. Beach has been taken away it is a comfort to him who has been associated with Mr. Beach during his long life of labor to feel that the ever active mind which never spared the apparently frail body may now be forever at rest.

THE HOUSING OF THE WORKING PEOPLE—ITS ECONOMIC AND ETHICAL ASPECTS.

The eighth special report of the Commissioner of Labor, by Mr. Carroll D. Wright, which is devoted to the question of the housing of the working people, is distinguished by that breadth and detail which have made the United States government reports famous the world over.

The term working people is a very broad one, and includes in any country a great multitude which is capable of subdivision into classes that differ widely, according to their character and habits of life.

Mr. Wright makes a threefold division: First, the artisan class, which is composed of men who are well paid, and are steady, saving, and ambitious. They live in good homes, and, as a rule, make reliable tenants. Landlords provide comfortable houses for this class and are glad to have them as tenants.

The next class includes, first, the "unfortunate, who, through sickness or other misfortune, have grown deeply in debt," and become discouraged; and secondly, the "lazy and careless, and those who are not particularly intelligent or ambitious, or are possessed of bad habits." These make poor tenants, and landlords give them little encouragement. Generally speaking, it is the first half of this class that has been the object of model dwelling enterprises of a philanthropic character. Socially considered, they are on the "down grade," and if left to themselves, they are in danger of gravitating to the third class, which "includes the incorrigible, the drunkard, the criminal, the immoral, the lazy, and the shiftless."

The people in this lowest class are destructive as tenants and they pay rent only under compulsion. They have scarcely any domestic habits or instincts. Herding together in city slums, they live in a promiscuous disregard of sexual privacy that is utterly prohibitive of moral or social cleanliness.

A great philanthropist, Lord Shaftesbury, who for sixty years devoted himself to the improvement of the homes of the poor, says: "I believe that nothing has led to more misery of every sort, moral and physical, than burying those people in holes, where nobody saw them, and they saw nobody except those who lived immediately around them." There is but one remedy for the evils of the slum—to sweep it away. The vice and disease which breed quickly amid the darkness of slum and cellar life will disappear altogether, or in large part, if these unfortunate people be obliged to live in decent homes, amid sanitary surroundings, and with due regard to the sexual separation which is necessary to the decency of domestic life.

The case made out by this report may be summed up as follows:

1. The workman is paying too much rent. The sum expended in this way should never amount to more than 20 per cent of his weekly wage. In some European countries it rises as high as 30, 40, and even 50 per cent.

2. The accommodation which he receives is often cramped, unhealthy, and badly situated.

3. This high rent and overcrowded accommodation is not necessarily the fault of the landlords. It grows out of the fact that the working man, especially if his work be of an intermittent character, must of necessity live near his sphere of labor. This has naturally led to a rise in the price of building land in the neighborhood of factories; and statistics show that the price of land, and the cost of building, have risen faster than the rate of wages among the working classes has increased. The householder will inevitably try to ease the burden of rent that lies upon him by the subletting of rooms, and hence arises the excessive overcrowding which obtains in all large manufacturing centers.

4. The most promising solution of the difficulty lies in the direction of increased rapid transit facilities. This would bring the speediest relief to the congested districts. No people enjoy the freshness and freedom of the country so keenly as the working classes; and as soon as it is in their power to enjoy the comforts of country cottage life and at the same be within reach of their daily work, there will be a large exodus to the suburbs. This would result in a lowering of rents, and an increased accommodation for those that remained in the city dwellings.

With a view to encouraging this migration to the country, the London County Council has recommended what is known as a model zone system, by which a tariff, equivalent to a mean rate of one-fifth of a penny a mile up to twenty miles, is charged on special workmen's trains to and from the suburbs.

Belgium offers such cheap rates that the working people are able to live in the farthest outskirts of Brussels, and yet go to work in the city at an expense for railway fare of only four to five cents a day.

	Per cent.	Per cent of net profit.
Improved Dwellings Association, New York City	5	6
Boston Co-operative Building Company, Boston, Mass.	6	9·96
Improved Industrial Dwellings Company, London, England	5	8
Rosemount Dwellings for Working People, Edinburgh, Scotland	6	..
Rouen Cheap Dwellings Company, Rouen, France	3	8
Berlin Building Association, Berlin	5	..
Amsterdam Association for Building Laborers' Dwellings	5	..

That model housing can be made to pay, is proved by the above table published in the report, which shows dividends paid, and per cent of net profit earned, by various companies for the last year for which such returns were available.

The solution of the problem of housing the working classes is to be found in the co-operation of model housing companies that will be satisfied with a moderate rate of interest, with a combination of the various transportation companies that will make cheap rates for the laboring classes.

The remark of Georges Picot that, "The improvement of dwellings is the best guarantee of civilization," is borne out by the observation of the philanthropist Shaftesbury, who testified, as the result of his many years of labor, that he was "certain that many people who are in a filthy and deplorable condition have been made so by their own surroundings."

Any influence that tends to destroy the individuality of the man or the family is to be deplored. The herding and swarming of city life does this. Any influence that tends to emphasize the individuality of the man or the family is fraught with lasting benefit. The separate cottage dwelling, with its breathing space of surrounding fruit and flower garden, sheltering but one family, and owned by one man, is capable of bringing more physical, moral, and social blessedness into the life of the working people than all the other philanthropies of Christendom combined.

Another Large Racing Yacht.

According to Engineering an order has recently been placed with Messrs D. & W. Henderson, of Partick, Scotland, for "an exceptionally large racing yacht," which is to carry the enormous sail spread of 20,000 square feet.

She is to be built from the designs of Mr. Geo. L. Watson, the designer of Thistle and the three Valkyries; but the owner's name has not yet been made public.

The sail area of Defender and Valkyrie III was respectively 12,640 and 13,026 square feet; and a well-known yachting expert has spoken of them as "overcanvased brutes." It was confidently asserted last year that the limit of possibilities in size had been reached, and that future yachts would show a return to more convenient and reasonable dimensions. Yet, according to this report, the new boat will exceed this year's racers in spread of canvas by about 60 per cent. Last season's boats drew about 20 feet of water; and if the projected yacht be deep in proportion to her power, she will be as awkward to bring in and out of harbor as a man-of-war.

A CABLE 2,184 meters long is to be laid in the Amazon River between Para and Manaos, an ordinary telegraph being impracticable, on account of the impenetrable forest.

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THE EAGLE BICYCLE.

(Continued from first page.)

public, the Eagle Bicycle Manufacturing Company produced a strikingly handsome machine of this type. Its makers have since been guided by the same progressive views, tempered with proper conservatism as in the early days.

The Eagle bicycle of to-day is a typical American wheel, and our illustrations will serve to show our readers some of its distinguishing features of construction.

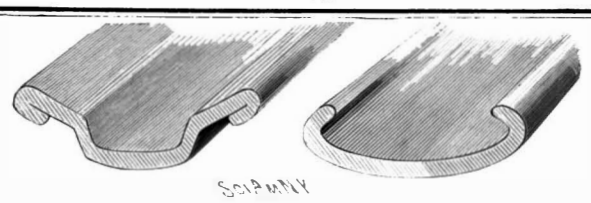
During the year 1895 a number of new factories have been built especially designed for the manufacturing of bicycles. The last, and perhaps the largest, of the new plants erected is that of the Eagle Bicycle Manufacturing Company, of Torrington, Conn., a cut of whose new factory we herewith show. It is situated in a valley devoted almost entirely to the manufacture of metals into various articles and devices, the infinite variety of which is probably unequaled in any other one section of equal area in the country. Torrington is located between the cities of Bridgeport and Winsted, the two terminal points of the Naugatuck Railroad, covering a distance of hardly fifty miles, and there are fully 100.000 people engaged in the various manufacturing plants of this remarkable valley.

The new factory is situated directly on the line of the railroad and will have its own switch therefrom for shipment of wheels and reception of coal and stock. The large shops are built on the most approved plan, the roof with numerous vertical windows, giving a perfect light for machine rooms. The best possible construction of countershafting is employed, one man being able to keep a line of it in motion by pulling at the belt, so perfect is its alignment. The new enameling ovens are worthy of special mention from their size and completeness. The factory has its own gas and electric plant, so that all operations are under its own control. From the main office, the entire area of the main shop is visible. The offices with draughting and rooms devoted to correspondence only, occupy two full floors of the office building.

In the Eagle bicycle cold swaging is extensively applied. The spokes are also cold swaged from the best imported wire, and have thickened ends, giving perfect immunity from breakage, a trouble of frequent occurrence in the past and giving unlimited annoyance to the rider. The ends of the tubes are reinforced by a cold swaging process, introduced by the Eagle Company some three years ago, patents on which are now pending. Into the ends of each main frame tube a section of smaller tubing some three inches long is tightly inserted. This alone, in conjunction with the brazing, would be a good reinforcement. But in addition the end is inserted into the cold swager and is by the rain of blows rapidly and evenly reduced one quarter or one eighth of an inch in diameter. This brings the outer tube and its reinforcement into perfect contact, by cold swaging, reducing both in size and consolidating the steel, so that they practically represent one piece of metal. When brazed in place the whole is virtually one. All ends of the main frame tubes are thus treated, and the value of such reinforcement cannot well be overestimated. The tapering of the ends also gives a most graceful effect to the frame.

The fork sides are made from round, seamless tubing, tapered also in the cold swager. A mandrel is next used in further forging them into the proper flattened contour. They are then curved in a powerful press, so that they receive an identical outline in all cases.

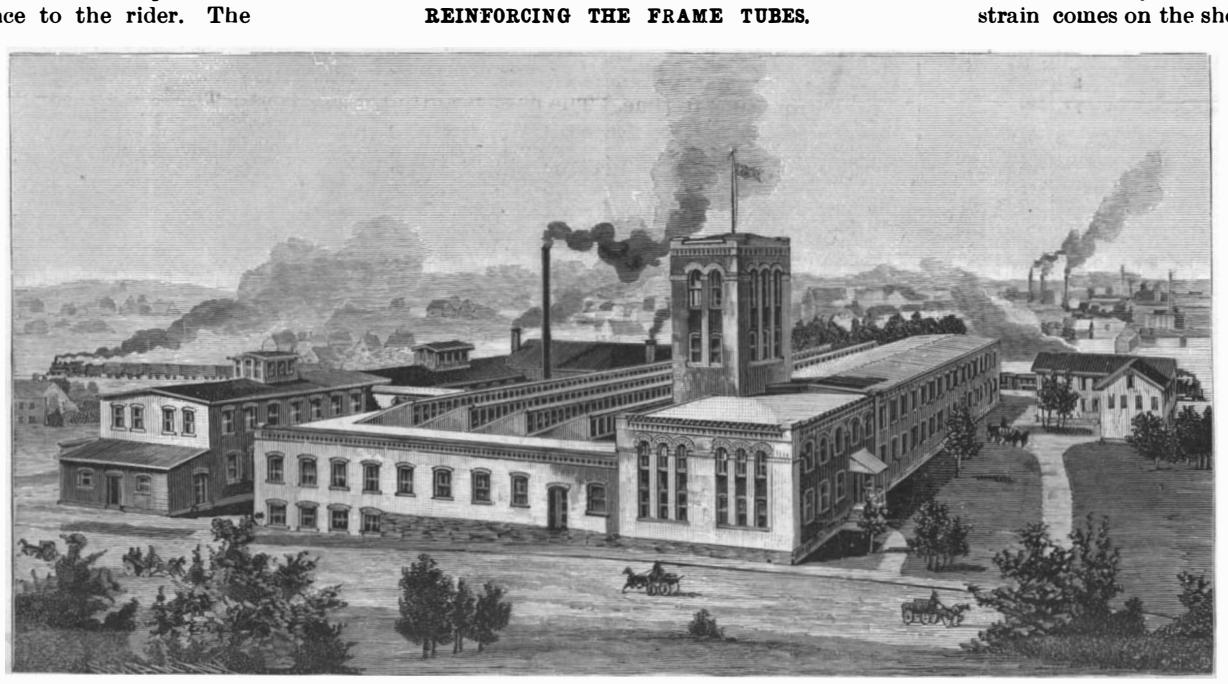
The assembling of the frame is an interesting process. The pieces being assembled in a heavy metal frame, called the "jig," are drilled and pinned together and are brazed, being subjected to operations of alignment between the brazing operations. Then, when all is put together the wheels must stand in precisely the same vertical plane, and their axles must not only be parallel to each other, but must be vertical to the plane of the wheel.



SECTIONS OF ALUMINUM RIMS.

ALUMINUM RIMS.

REINFORCING THE FRAME TUBES.



FACTORY OF EAGLE BICYCLE MANUFACTURING COMPANY.

EAGLE BICYCLE AFTER A COLLISION.

The variation of a sixteenth or even a thirty-second of an inch in cutting off the tubing used in the construction of a bicycle frame, or an equal amount of variation in pinning the frame together on the "jig," will cause the wheels, when fitted, to be entirely out of line with each other. In riding, they would not track, and the bicycle would run harder in consequence.

A common method of obviating this difficulty is to bend or twist the frame so that the wheels may be made to track. The detrimental results from such a remedy are obvious. It is not so with the frames used in Eagle bicycles. After each primary operation and before the frames are ready for re-enameling, they are lined up, not only by the inspector of the frame department, but later by the inspector of the assembling room. When a frame is found to be out of line, the work on it is immediately stopped, and such portions as are wrong are taken apart, unbrazed, the pins are driven out, and the frame is again set up—this time correctly.

Three characteristic features of the Eagle wheel are the aluminum rims, the detachable sprockets, and the three tube loop frame of the ladies' wheel. The aluminum rims are rolled from heavy sheet aluminum in the works of the company. New sections have been adopted. The one is for cemented or for Dunlop tires, and, by its beading, this rim is made very stiff. The other is adapted for clincher tires, especially the G. & J. tire, and is the ideal rim for this kind. Steel rims rust and injure the tire. Copper plating is sometimes resorted to for protection from this trouble. Wooden rims have given much trouble by splitting under the strain of clincher tires. The aluminum rim represents the combination of its own incorrodibility with the strength of steel and lightness of wood. It is really somewhat lighter than wood, and, like all metal rims, bends in accidents where a wood rim would break and be destroyed. It is calculated that $40,000 per annum represents the additional expense on an output of 20,000 wheels with aluminum rims.

The detachable front sprocket has its rim carried by five arms of a spider brazed to the crank axle. Five screws hold the rim in place, but the ends of the arms are received in depressions in the arms of the sprocket rim, so that the driving strain comes on the shoulders of solid metal and not on the screws. The rear sprocket screws bodily on the hub with a right handed thread, and is secured by a jam nut with left handed thread. Thus anyone can change the rear sprocket.

The loop frame we illustrate in a special cut. The original loop frame or ladies' wheel of the early days had but one tube. If this broke, a fall was the inevitable result. Then a second tube was added, placed almost universally directly above the lower one. In the Eagle loop frame the straight lower tube is supplemented by two curved tubes, placed above it and to right and left, so as to spread some three inches laterally. This operates to greatly increase the stiffness of the wheel and makes it even stronger against lateral strain than is the regular diamond frame. The Eagle ladies' wheel is unique, and is equipped throughout with aluminum dress and mud guards.

A bicycle which was run over forms one of the Eagle's trophies. While a complete wreck, not a tube, spoke or rim was broken, testifying to the perfection of the machine that can be bent but will not break.

It is needless to say that the hubs and bearings are turned out of the solid bar. One tendency of the factory which is always immediately noticeable to a visitor is the constant use of hand finish, not trusting too implicitly to automatic machinery.

OWING to the talk of assessing bicycles in the State of Maine, the State Assessors called for an estimate of bicycles ridden in the various counties. The reports of the local assessors show a total of 9,663 bicycles in use at a valuation of $500,000.

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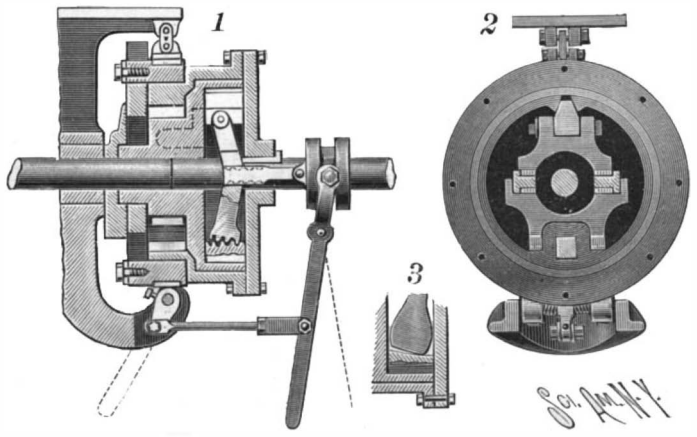
A VARIABLE SPEED POWER CLUTCH.

The clutch shown in the illustration is very similar to one described by its inventor in a paper contributed to Section G of the British Association for the Advancement of Science in 1893, and noticed at the time in SCIENTIFIC AMERICAN SUPPLEMENT, No. 932. It forms the subject of a patent recently issued to W. Worby Beaumont, 100 Palace Road, Tulse Hill, S. W., London, England. The improvement is designed to facilitate the starting of driven shafting or adjacent parts of machinery by overcoming the inertia of rest at a slow speed by positive mechanism, the full speed of the driver being afterward obtained, there being two positive gear speeds with optional intermediate speeds. There are two successively actuated clutches, one containing an epicycloidal gear by which it transmits power through the medium of part of the second clutch, the friction grip surface of which is in part provided with an extension into it of part of or an attachment to the eccentric or shaft in the first clutch. Fig. 1 is a sectional side elevation, and Fig. 2 an end elevation, part in section and the cover of the container removed, of the clutch as arranged for line shafting, Fig. 3 showing a modified form of friction clutch. A fixed eccentric on the driving shaft carries an externally geared ring on which are lugs sliding in slots in a disk, and when the latter does not rotate but slides on lugs on another ring, the first ring, under the action of the eccentric, receives a gyratory motion corresponding to twice the eccentricity of the eccentric. To prevent the rotation of the second ring, a band clutch is closed upon it, when another ring connected with a disk or cover keyed to the driven shaft is caused to rotate, communicating motion to the latter at a speed of perhaps one-fourth that of the driving shaft. The band clutch ring is then released and a second clutch formed by other parts is brought into action, increasing the speed of the driven shaft. By means of a lever the epicycloidal gear part of the combination may be brought into action to start the driven shaft at the speed proper to the ratio of the epicycloidal gear, and a friction full speed clutch may also be put into gear. The invention provides for several modifications of the parts and varying arrangement of the clutches, one of the modifications contemplating the operating of the friction surfaces of one of the clutches by an electromagnet.



BEAUMONT'S VARIABLE SPEED POWER CLUTCH.

RESTORATION OF THE OLYMPIAN STADIUM.

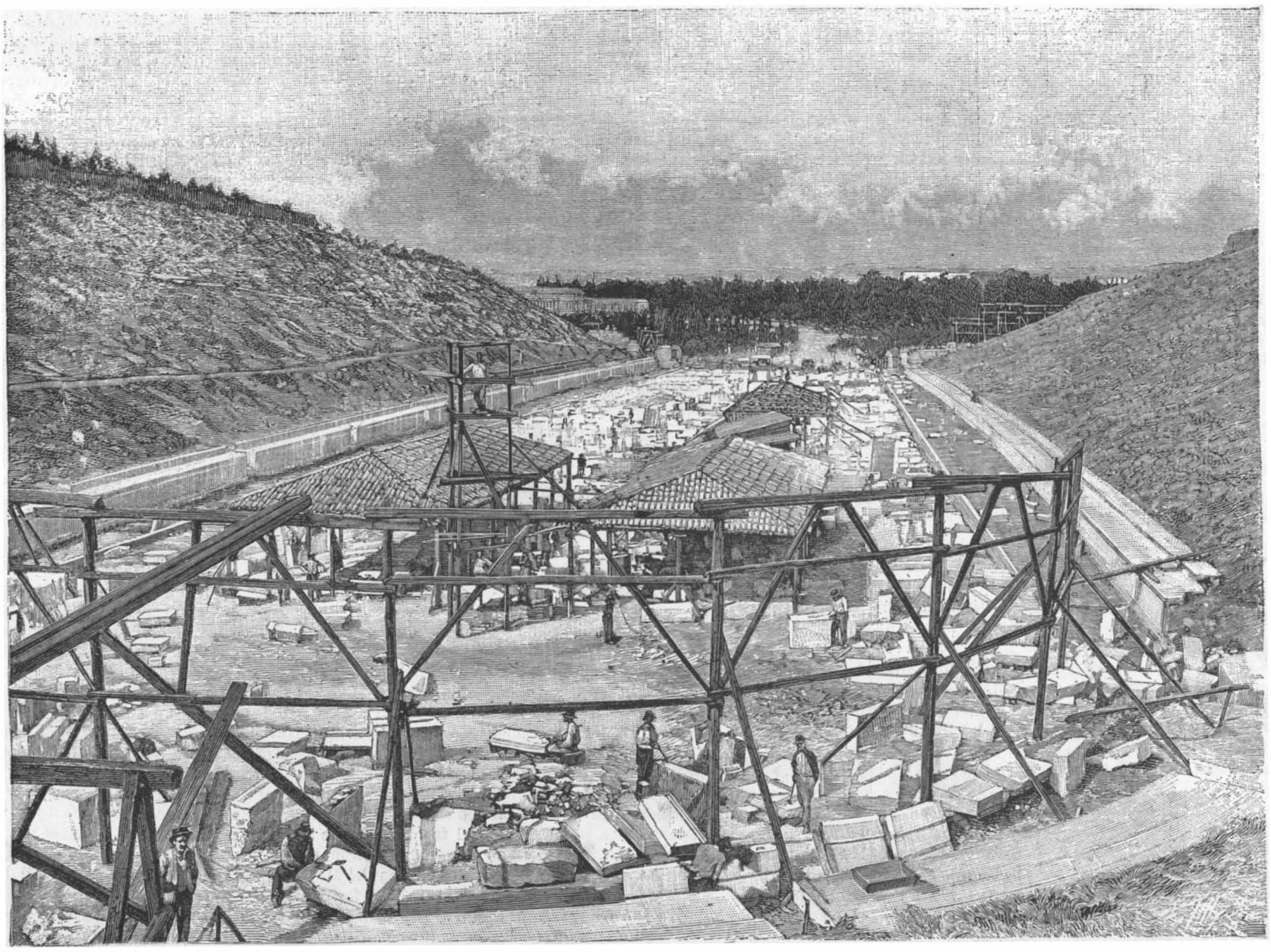
Greece, after exhuming marvels of art from her soil, is now preparing for a grand revival of the celebrated Olympian games. Thanks to the munificence of a rich citizen of Greece, M. G. Avéroff, the work of restoration of the Olympian Stadium or circus at Athens is now being carried on. Our engraving shows the actual state of progress of the restoration. The arena is situated between two hills. It is 656 feet long and 160 feet wide. The entrance is at the northern end. The southern end from which the photograph was taken ends in a hemicycle. Twenty-five ranges of seats rise on three sides of the arena. The seats, steps, parapet, etc., are built of stone from the Piraeus and of Pentelic marble. The steps are ten feet wide. Under the hill at the east has been dug a vaulted passage which gives the athletes direct access to the arena. Great care has been taken to reproduce the ancient stadium, the ruins of which have been diligently studied. Fifty thousand spectators can find a place around the arena. From the top of the hemicycle the view is grand, embracing the amphitheater, the palace of the king and the palace of industry. For our engraving we are indebted to L'Illustration.

The Alps of Japan.

At a recent meeting of the Royal Geographical Society a paper on "Exploration in the Japanese Alps, 1891–1894," was read by the Rev. Walter Weston, M.A. The range might be briefly described as a backbone or axis of granitic rocks, through or over which vast quantities of igneous and volcanic rocks had been poured from time to time. The most beautiful mountains in form were Hodakayama, whose granite towers gave it the name of the "mountain of the standing ears of corn," and its northern neighbor Yarigatake, "the Spear Peak," the Matterhorn of Japan, which consisted of an intensely hard, weather-resisting porphyry breccia. The inaccessible character of the range cut off nearly all intercourse between the people on either side. Near the hot springs of Tateyama striking evidences were seen of the terrific power of seismic phenomena. All around the spot was a wilderness of large bowlders, sand, and stones. Although thunderstorms were usually neither frequent nor violent in most parts of Japan, they were by no means uncommon in the central parts of this range. Some of the sulphur springs were very remarkable, especially those on Tateyama toward the north of the range. They were called O jigoku ("great hell"). Jets of steam and sulphureted hydrogen burst forth sometimes with a deafening roar, and with force enough to project lumps of sulphur deposit to a distance of 15 or 20 feet. In the mountains, wherever hot mineral springs were found, the peasantry resorted to them, some for the sake of the healing virtues of the waters and others to kill time pleasantly. The yuba, i. e., "hot water houses," as these bathing establishments were called, usually nestled at the bottom of some deep ravine, or occasionally were found perched high up on the slope of one or other of the great volcanoes. The temperature of the water varied from 100° to 130° Fah.

This taste for bathing was indulged to an incredible extent. In one place he knew of, where the water was just about blood heat, a man would stay in practically for a month on end, taking care, however, to place a heavy stone on his knees to keep him from floating or turning over in his sleep. The caretaker of this particular establishment, a cheery old man of some 70 summers, himself stayed in the bath the whole winter through.

Chief among the animals found in this alpine region was the kuma, or black bear. It sometimes attained a length of over six feet, and its flesh was smoked and eaten. In the north end of the range the badger was very common and was much valued, both for its flesh and its fur. In the forests high up the mountain sides boars were found. Deer were also hunted in the winter. Of birds, the beautiful golden eagle led the way. Besides the kite, which was common, was a curious black and white speckled crow (regarded in Japan as the bird of love), and extremely tame ptarmigan abounded near the upper snowfields. The most remarkable animal of all, however, was now fast dying out. This was the giant salamander (Cryptobronchus japonicus), found chiefly in the southwest spurs of the range.



REVIVAL OF THE OLYMPIAN GAMES IN GREECE—RESTORATION OF THE ANCIENT STADIUM.

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Animals' Change of Color in Cold Countries.

As winter approaches and the green of summer is replaced by snow and ice, a peculiar change occurs among certain animals. At the first hint of cold they begin to assume a different color; tints of gray and lighter hues appear in the somber black or dark coat of summer, and soon the animal is mottled with dark and white patches, finally becoming a pure white that is at once a protection, rendering it almost invisible on the snow. Before the change was understood it was supposed that the animals were distinct forms; one white and the other dark. But it is now well known that a number of animals change their color with the regularity of the seasons, says the Philadelphia Times.

One of the most interesting examples is the hare, several of which are known to assume a winter pelage, the most familiar being the varying hare and the Arctic hare. The latter, in summer, when it would in a winter coat present a marked and striking contrast to its surroundings, is on its upper side black and a light brownish yellow, mixed; the upper portions of the tail and the tips of the ears black. This color is retained all through the summer, but at the approach of the cold season the pelage begins to fade and gradually becomes white, with the exception of the tips of the ears, which remain black.

This wonderful changeable hare is found in the Alps, Ireland, and Scotland, and in the Arctic regions of Asia. In many of the Arctic explorations it has been of the greatest service to the men from its habit of frequenting camps. The voyagers of the Vega often relied upon the little animals in time of need and when food was scarce.

In America, in the far north, we have the same hare, but a larger and finer animal, known as the polar or glacier hare. The American form ranges from the north to the middle portions of the country, and in regions away from the extreme north changes only slightly or imperfectly. As the cold comes on, its dark coat fades to a lighter hue, becoming pronounced in summer again.

The protection afforded these animals in the far north is almost perfect, as it is almost impossible to distinguish them from the snow. When they run they seem to be swallowed up in the field of white.

The principal four-footed enemy of the white hare is the Arctic fox, that is endowed with a similar protection. It is one of the smallest foxes known, and certainly one of the most beautiful. In summer, when the ground is bare or covered with verdure, the little animal has a silky fur, bluish or brownish gray. This lasts until the snow comes, when the coat gradually changes. The hair becomes longer and thicker, especially on the tail and feet, which are densely furred, and by midwinter, or before, it is pure white, without a suspicion of its summer hue.

If the winter and summer pelage be contrasted, it will hardly seem possible that they represent the same animal. The fox is a very cunning and intelligent creature, as all Arctic travelers have discovered. It is an inveterate thief, stealing for the pleasure of stealing, taking from the Vega explorers not only food, but knives, forks, ammunition, sacks, shoes, and stockings. When the men slept they would crawl under the robes and nose them, and if those awake held their breath, pretending to be dead, the foxes would begin to nibble them, and when frightened off would carry away a hat, mittens, or anything that came in the way. If followed, one of the foxes would go on guard while the others buried the stolen goods.

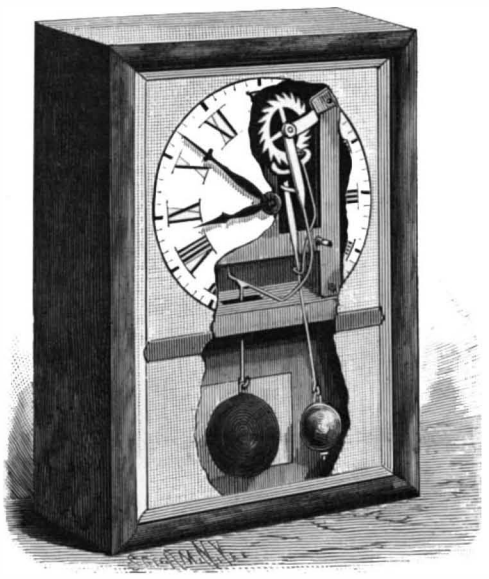
The ermine, whose fur has become fashionable again, is a familiar example of this remarkable change in color. It is common in all the northern countries and in our own country down to the Southern States, a most destructive little creature, killing chickens, birds, and various animals, often simply for amusement. An ermine has been observed watching a bird, placing itself beneath an inviting roost; when the bird alighted it sprang at it, clinging to it, although carried a long distance into the air.

Some curious experiments have been tried with this little animal. Four or five were caught one summer in the north, and found to have rich coats of a mahogany brown color. Two were sent to some one in the Southern States, while the remainder were kept where the cold winter prevailed. Those in the north began to change as the leaves disappeared, the strange painting of nature gradually going on until the animals, with the exception of the tip of the tail, were pure white. Correspondence had been kept up with those having the other ermines in charge, but in vain they looked for the winter change. The animals retained their mahogany colored coat during the warm winter, showing conclusively that the change is produced by the cold, and is a wise provision of nature, rendering the animals almost invisible to their enemies.

There is another reason given for the change—a wise provision of nature to protect the ermine from the cold. Animals with black or dark colored fur radiate internal heat more effectually than those of lighter colors; so the ermine in its white coat absorbs the rays of the sun, radiating but little; thus the change becomes an important factor in the preservation of the heat supply. In their movements these animals and their allies resemble serpents, and the actions of an ermine stealing along with sinuous motion over the snow is very suggestive.

ADJUSTING THE BEAT OF CLOCK PENDULUMS.

The illustration represents a leveling device adapted for attachment to a clock mechanism to control the pendulum and verge, whereby they will be kept plumb, irrespective of the frame carrying the clock mechanism proper. It is a patented improvement of Fred F. Richey and William Bittmann, of Wamego, Kansas. The clock mechanism may be of any desired construction, and the verge wheel shaft is jour-

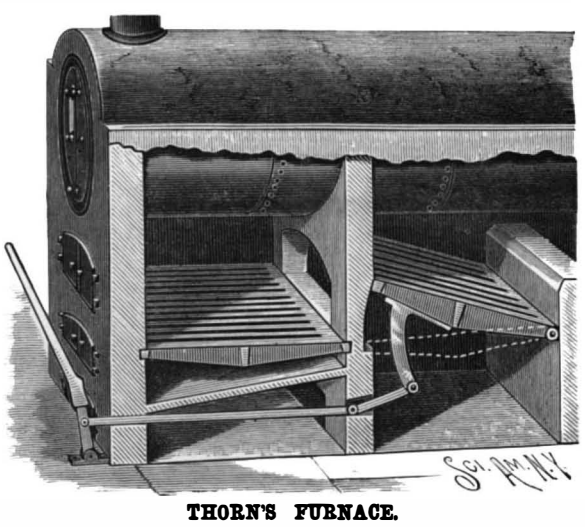


BITTMANN & RICHEY'S CLOCK PENDULUM.

naled in the frame at the back and in a bracket projected at the front, each bearing being formed with a boss having an integral stud, and on the studs being pivoted the upper members of a U-shaped frame from which depends a weight. The front member of the U-shaped frame is at all times in front of the verge rod, while the rear member is straight. On the inner face of the front member is pivoted a block in which is journaled one end of the verge spindle, its opposite end being held in the usual spring. The verge is thus carried by the weighted swinging frame, and the pendulum rod at its upper end, after passing through the verge, is secured in the usual manner to a post, which is also secured to the back of the forward member of the weighted frame, whereby both the pendulum and the verge are kept perfectly plumb. The device is very simple and inexpensive.

AN IMPROVED FURNACE.

The furnace shown in the accompanying illustration is designed to insure a more complete and efficient combustion of the fuel than is possible with furnaces of the ordinary construction, by the employment of an auxiliary grate in the rear of the front grate, the rear



THORN'S FURNACE.

grate receiving the burning or coked fuel from the front grate, and the smoke and gases from the burning fuel on the front grate passing through the fuel burning on the rear grate.

The improvement has been patented by A. L. Thorn, of Lump City, Montana. In a rear combustion chamber, pivoted to the rear bridge wall, is an auxiliary grate, the front of which is adapted to rest, as shown in the dotted lines, on an intermediate grate wall, in the center of which is an opening immediately at the rear of the front grate, so that the fuel from the latter may be conveniently pushed upon the rear grate. Under the front grate is an ash pit with inclined bottom, and the ash pit under the rear grate has an extension under the front ash pit and a separate door. An arm extending downwardly from the rear grate is connected with an exterior lever, by which the grate may be moved up and down, the illustration representing the furnace with the grate in normal position, so that the smoke and gases from the burning fuel on the front grate bars will pass through the fuel on the auxiliary grate, the latter being lowered occasionally to permit the burning fuel on the front grate to be pushed back on the rear grate, the latter being then again raised. The lower ash pit door is normally closed, to prevent the passage of outside air to the rear ash pit, and it is designed to use a water grate in the second combustion chamber, the water thus heated being used as a boiler feed.

The Hardening of Extra Soft Steel.

The subject of the hardening of extra soft steel was dealt with at a recent meeting of the Académie des Sciences, in Paris, by Mr. Osmond. Taking for example a test bar of steel carbonized by cementation in which the proportion of carbon varies in a continuous fashion (from 1·70 to 0·35 per cent) from one extremity to the other, if the bar be well hardened, and an attempt be made to scratch it by means of a sewing needle, the latter will scratch the softer parts—say, up to the part containing about 0·70 per cent carbon. The mark or scratch then disappears, but, contrary to all expectation and to all ideas on the subject, it reappears in the part of the bar containing a proportion of carbon of about 1·30 per cent.

In examining the scratch or mark by means of a microscope in the most carbonized part, it is found not to be continuous, but that it appears to be a series of broken or interrupted lines. The part in question is therefore not homogeneous and contains at least two constituents, which may be here named A and B respectively. A, not scratched by the needle, scratches glass and feldspar. B is scratched by apatite, and probably of fluorspar. By giving them a good polishing, a slight difference in color will be found between the two constituents: B is of a silver-white color, while A has a slightly grayish tint. Polishing in bass-relief on damp parchment, impregnated with a little brown-red, does not sensibly affect B, thus assigning to this constituent a resistance to inordinate wearing, having regard to its relative mineralogical hardness. By attacking it with tincture of iodine or by dilute nitric acid the mass is divided into only slightly coherent polyhedrons, separated or not by traces of definite carbon, to which is attributed the formula Fe_3C. At the same time A and B assume different colors, but are ordinarily homogeneous for the same constituent within the limits of the same polyhedron. The structure thus becomes very clearly defined. In most cases, A becomes distributed in barbed flakes parallel to two directions, which remain constant for each polyhedron; B forms the base. If the attack be prolonged, all the section becomes black, both constituents being carbonized. The hard constituent, A, is the same which forms almost exclusively hardened steel containing 1 per cent carbon. The proportion of the constituent B increases with the content of carbon up to about 1·60 per cent. To continue the experiments, by taking a steel not more complex but of a composition which has been found most convenient (for example, a steel containing 1·57 per cent carbon), and submitting it to a varying hardening process, it will be seen that to obtain the maximum of B, the steel must be heated up to at least 1,000° Cent. (but not exceeding 1,100° Cent.), and cooling it as rapidly as possible in iced water or in very cold mercury, otherwise the carbon, Fe_3C, becomes isolated again and diminishes to that extent the actual content of carbon in the remainder of the mass. Under the most favorable conditions, it is possible to obtain a mixture of equal parts (in round figures) of A and B. Such a mixture is, relatively, only slightly magnetic. A bar of it, with one far end placed against one pole of a powerful horizontal magnet, is supported vertically with difficulty, while a similar bar, hardened by heating up to 800° Cent. and cooling at 15° Cent., is held horizontally.

The same mixture, with the parts A and B practically equal, cannot be filed, and breaks before it bends, owing both to the presence of the hard and fragile constituent, A, and to the absence of cohesion between the polyhedrons. So far as it has been able to ascertain them from a mixture, the properties of B tend to make it similar to steel, having 25 per cent nickel and from 12 to 13 per cent manganese.—The Colliery Guardian.

Sir Edward Harland.

Sir Edward Harland, head of the famous shipbuilding firm of Harland & Wolff, died December 24. He was a member of Parliament for North Belfast in the Conservative interest, was sixty-four years old, and was twice mayor of Belfast. His partner, G. W. Wolff, is member of Parliament for East Belfast in the Conservative interest, and, Mr. Wolff being of German extraction, they were known in the House of Commons as the Majestic and Germanic. Sir Edward Harland was for many years chairman of the Harbor Commissioners of Belfast, and was a bulwark of Conservatism in Ulster. He was one of the foremost organizers of the Ulster convention. His baronetcy was the gift of Lord Salisbury and dates from 1885.

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Speed of Vehicles and Pedestrians.

BY JAMES ASHER.

The speed of a railway train in miles per hour can be found by counting the number of rails over which a car wheel passes in 20·3 seconds, because 20·3 seconds bears the same ratio to an hour that 30 feet, the length of a rail, bears to a mile. The fish plates or the thumps may be counted. Thus, supposing that 39 thumps are made by a wheel in 20·3 seconds, the train is then running at the rate of 39 miles an hour.

The rate of a train, or any other moving body, can easily be found where there are posts half a mile apart. I have prepared a table for this purpose, which I give here:

Miles per hour.	Min.	Sec.	Miles per hour.	Min.	Sec.
1	30	00·0	61	0	29·5
2	15	00·0	62	0	29·0
3	10	00·0	63	0	28·5
4	7	30·0	64	0	28·1
5	6	00·0	65	0	27·6
6	5	00·0	66	0	27 2
7	4	17·1	67	0	26·8
8	3	45·0	68	0	26·4
9	3	20·0	69	0	26·0
10	3	00·0	70	0	25·7
11	2	43·6	71	0	25·3
12	2	30·0	72	0	25·0
13	2	18·4	73	0	24·6
14	2	08·5	74	0	24·3
15	2	00·0	75	0	24·0
16	1	52·5	76	0	23·6
17	1	45·8	77	0	23·3
18	1	40·0	78	0	23·0
19	1	34·7	79	0	22·7
20	1	30·0	80	0	22·5
21	1	25·7	81	0	22·2
22	1	21·8	82	0	21·9
23	1	18 2	83	0	21·6
24	1	15 0	84	0	21·4
25	1	12·0	85	0	21·1
26	1	09·2	86	0	20·9
27	1	06·6	87	0	20·6
28	1	04 2	88	0	20·4
29	1	02 0	89	0	20·2
30	1	00·0	90	0	20·0
31	0	58·0	91	0	19·7
32	0	56·2	92	0	19·5
33	0	54·5	93	0	19·3
34	0	52·9	94	0	19·1
35	0	51·4	95	0	18·9
36	0	50 0	96	0	18·7
37	0	48·6	97	0	18·5
38	0	47·3	98	0	18·3
39	0	46·1	99	0	18·1
40	0	45·0	100	0	18·0
41	0	43·9	101	0	17·8
42	0	42·8	102	0	17·6
43	0	41·8	103	0	17·4
44	0	40·8	104	0	17·3
45	0	40·0	105	0	17·1
46	0	39·1	106	0	16·9
47	0	38·2	107	0	16·8
48	0	37·5	108	0	16·6
49	0	36·7	109	0	16·5
50	0	36·0	110	0	16·3
51	0	35·2	111	0	16·2
52	0	34·6	112	0	16·0
53	0	33·9	113	0	15·9
54	0	33·2	114	0	15·7
55	0	32 7	115	0	15·6
56	0	32·1	116	0	15·5
57	0	31·5	117	0	15·3
58	0	31·0	118	0	15·2
59	0	30 5	119	0	15·1
60	0	30·0	120	0	15·0

A ship's rate is sometimes found by a log line or string, about 900 feet long, on a reel and having one end fastened to a thin sector shaped piece of wood named a log. The arc of the log is loaded to make the wood stay vertical when tossed into the sea; it then remains in the same place in the water while the line is unwinding from the reel. A sand glass, through which the sand flows in one $\frac{1}{120}$ of an hour, measures the time. The line is divided into equal parts of 50 feet each, called knots or $\frac{1}{120}$ of a nautical mile. Since a half minute has the same ratio to an hour that a knot has to a nautical mile, the ship runs at the rate of as many nautical miles an hour as it runs knots in half a minute. If say 19 knots pass in half a minute the vessel is then running at the rate of 19 miles an hour.

In another kind of log a small wheel like a screw propeller is fastened to a cord in the water. The other end of the cord in the ship bears hands. As the ship advances, the wheel and the cord continually turn and the rate of the ship is indicated by timing the rotation of the hands of the instrument on the ship.

Many ships now use an electric log, in which a screw wheel in the water occasionally closes an electric circuit and so operates indicating mechanism on board the ship. Neither this log nor the one just described needs ever to be drawn in. The electric log gives very accurate indications. Not only may the speed be indicated by the two logs just described, but they can show the total distance sailed over.

The rate of bicycles and carriages is sometimes found by an instrument which operates like the governor of a steam engine. The higher the speed is, the greater is the centrifugal force, which causes balls to diverge or mercury to rise higher along the side of a vertical cup and point out the speed on a dial.

The writer has recently invented several methods of finding the speed of carriages, bicycles and pedestrians, which will now be explained.

For common wheeled carriages let x = the time constant in seconds and r = the radius of the carriage wheel in inches, then $\frac{x}{3600} = \frac{3\frac{1}{7} \times 2\,r}{63360}$. $\therefore x = \frac{5\,r}{14}$

This equation says that the interval in seconds during which the rate per hour equals the number of turns made by the carriage wheel in that number of seconds is equal to $\frac{5}{14}$ of the radius of the wheel in inches. For example, the time constant of a carriage wheel 42 inches in diameter is $\frac{5}{14} \times \frac{1}{2} \times 42 = 7\frac{1}{2}$ seconds, and if we count say 17 turns of that wheel in $7\frac{1}{2}$ seconds, the carriage is then running at the rate of 17 miles an hour. A bright spot one inch in diameter painted on the hub, the slowest part of the wheel, is useful in counting the number of turns made by the wheel. Carriage makers should make such a spot on one wheel of all carriages, and they should also mark the time constant of the wheel on this spot. A small tin disk, an inch in diameter, may be tied on the hub instead of having a painted spot to determine the rotations.

Following are the time constants of carriage wheels and old fashioned bicycle wheels:

Diameter of wheel in inches.	Time constant in seconds.	Diameter of wheel in inches.	Time constant in seconds.
40	7·1	51	9·1
41	7 3	52	9·2
42	7·5	53	9·4
43	7·6	54	9·6
44	7·8	55	9·8
45	8·0	56	10·0
46	8·2	57	10·1
47	8·3	58	10·3
48	8·5	59	10·5
49	8·7	60	10·7
50	8·9		

For common bicycles which have two sprocket wheels the time constant is $\frac{5\,r\,T}{14\,t}$ when r = radius of hind wheel of bicycle, T the number of teeth in the larger sprocket wheel, and t the number in the smaller. Example: What is the time constant of a bicycle whose hind wheel has a radius of 12 inches, the number of teeth in the larger sprocket wheel is 28, the number of teeth in the smaller is 10?

Solution: Substituting in the formula we have $\frac{5 \times 12 \times 28}{14 \times 10} = 12$ seconds.

All that the wheelman on this bicycle, or an observer some distance off, need do to find the rate of this bicycle at any time is to count the number of times he presses down one of his feet in 12 seconds. Thus, if he presses his foot down 14 times in 12 seconds, he is then traveling at the rate of 14 miles an hour.

A cyclist may sometimes with advantage use ten times the time constant of his bicycle, or a driver may do the same with the constant of his carriage, and a pedestrian may do the same with his own constant. When this is done, the number counted must be divided by 10. This is done simply by regarding the right hand figure as tenths of miles and the other figures as miles. Thus, if a person counts 134 down strokes of his foot in 10 times the time constant of his bicycle, he is then riding at the rate of 13·4 miles an hour.

Bicycles are distinguished by their gear, $\frac{2\,r\,T}{t}$, which is the diameter in inches which a bicycle of the old style, having the pedals on the wheel shaft, would need to go the same distance as the given bicycle when the pedals on both perform a revolution.

Thus, when we say that a modern bicycle has a gear of 84 we mean that each revolution of the pedals carries the bicycle as far as an old style bicycle 84 inches in diameter, having the pedals on the drive wheel axis, is driven along during one revolution of its pedals.

The gear of a bicycle is found by multiplying the diameter of the hind wheel in inches into the number of teeth in the larger sprocket wheel, then dividing the product by the number of teeth in the smaller sprocket wheel. Thus, the gear of a bicycle which has 25 teeth in the larger sprocket, 10 in the smaller, and has a hind wheel 24 inches in diameter is $\frac{25 \times 24}{10} = 60$.

Since the time constant $\frac{5\,r\,T}{14\,t}$ divided by the gear $\frac{2\,r\,T}{t} = \frac{5}{28}$, the time constant may be found by multiplying $\frac{5}{28}$ into the gear of the bicycle.

Thus the time constant of a bicycle whose gear is 56 is $\frac{5 \times 56}{28} = 10$ seconds.

Here are the constants for bicycles of 13 different gears:

Gear.	Time constant.	Gear.	Time constant.
50	8·9 sec.	70	12·5 sec.
52	9·2 "	82	14·6 "
54	9·6 "	84	15·0 "
56	10·0 "	88	15·7 "
57	10·1 "	89	15·8 "
60	10·7 "	91	16·2 "
63	11·2 "		

The radius of the hind wheel should be taken as the distance from the axis to the ground, when the seat sustains the weight of the rider, for the pneumatic tire is compressible.

The time constant of a pedestrian can be approximately found on principles similar to the foregoing. First find the average length of step in inches. Let x = time constant and s = average length of step.

Then $\frac{x}{3600} = \frac{s}{63360}$

That is to say that the time constant bears the same ratio to the number of seconds in an hour that the average length of step in inches bears to the number of inches in a mile. Solving the equation, we find that $x = \frac{5}{88}\,s$. Now, since $\frac{5}{88}\,s$ is a very small number, 10 should always be multiplied into it; then the number of steps in this time may be divided by 10 by simply regarding the right hand figure as tenths and the left hand figures in the numbers as miles. For example, if a man's constant is 1·78 seconds, he would count the number of steps taken in 17·8 seconds, and if he takes, say, 38 steps in this time, he is walking at the rate of 3·8 miles an hour. The average length of step when walking very rapidly should be found, then the average length when walking very slowly; the mean of these two averages may be taken as the person's average length of step. For example, in walking very rapidly over 100 yards I found that my average length of step was 36 inches; in walking over the same distance very slowly the paces had an average length of 27 inches. I now regard $\frac{36 + 27}{2} = 31·5$ inches as my average length of pace in calculations for speed. It is, of course, impossible to obtain as accurate results by this method as we can with wheels.

A pedestrian walking on a railway may find his rate in the same way as the rate of a train, explained in the beginning of this article: but it is better to count the number of rails passed in 10 × 20·3 seconds, or 3 minutes 23 seconds, then regard the right hand figure as tenths and the left hand figures as miles. This method is very accurate.

A person when walking or driving may find his rate by counting telegraph poles. If they are set 176 feet apart, or 30 to the mile, the number of poles counted in two minutes exactly indicates the rate in miles per hour.

Thus, if he passes 4 poles in 2 minutes he then travels at the rate of 4 miles an hour.

This method is available for finding the rates of sleighs or of a horse when the traveler rides in a saddle. The rate of a horse may also be approximately found by finding his average length of pace and proceeding as in the case of a pedestrian, explained in a foregoing paragraph.

The rate of a pedestrian or a vehicle can also be easily found by counting the number of ridges in fields passed or fence posts along the road if the time constant has been found on principles like those explained in the present article.

Resonance and Echo in Large Halls.

Architects should keep in mind the golden rule, that resonance, such as is to be obtained by thin elastic linings, or even by masses of air judiciously distributed, is a thing to be sought in designing rooms for hearing music, or for public speaking, while echo, such as is produced by hard, unyielding surfaces, is to be avoided as much as possible. Every architect who has ever designed a music room for a private house knows how greatly the effect of music is improved by lining the walls of the room, and if possible the ceiling, with thin wooden paneling; and every layman who has ever bought a piano must have noticed what depth and richness is given to the tones of one played in the dealer's wareroom by the sympathetic vibrations with which the strings of the surrounding instruments respond to the playing.

For twenty centuries, at least, architects have sought in various ways to secure similar resonance in large rooms, understanding thoroughly the advantages to be derived from it. The Gewandhaus, at Leipsic, reputed to be acoustically the most perfect music hall in the world, owed its quality to the fact that it was surrounded by thin partitions, set at a little distance from the main walls of the building, which by their own elasticity, joined to that of the mass of air between them and the walls outside, provided the resonance which experience has shown to be indispensable. In the same way, La Scala Theater, at Milan, one of the largest and acoustically the most perfect of all European theaters, was lined throughout with thin woodwork.

The ancient Greeks to secure resonance without the use of woodwork, placed under the seats of their theaters earthen pots, with the mouth turned toward the stage, the vibrating mass of air in these serving to reinforce the sound. On the other hand, rooms in fireproof buildings, surrounded on all sides by hard, rigid masses of masonry, are very apt to be acoustically bad. Even where the large rooms, by careful study of their proportions, are successful, the smaller rooms, which cannot be so proportioned, are in such buildings almost always intolerably noisy.—American Architect.

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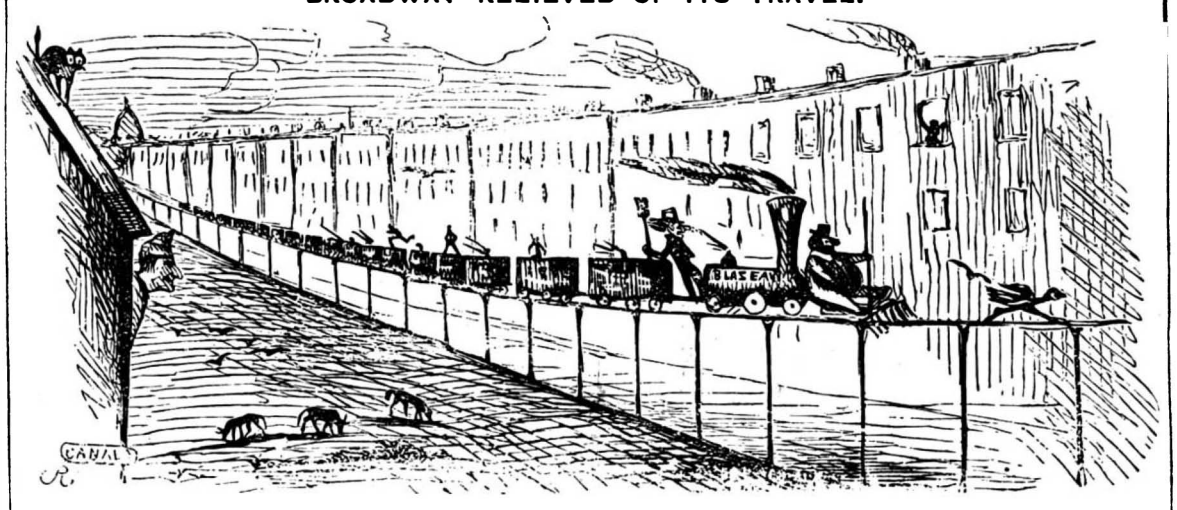
THE FIRST PROPOSED ELEVATED RAILROAD FOR NEW YORK.

In the accompanying cut we publish a view of an elevated railroad for New York which is reproduced in facsimile from a comic paper published in 1846.

158 YANKEE DOODLE.

BROADWAY RELIEVED OF ITS TRAVEL.



A Report signed "many citizens of Watertown" has recently demonstrated, as far as logic can demonstrate, that, "all things considered, a Plank Rail Road is the most advantageous and *cheapest* that can be constructed over a soil not naturally fitted for road-making." To prevent the mortification of being beaten by an obscure country town, YANKEE DOODLE calls upon the city authorities at once to take this matter in hand—not the road—but the feasibility of adapting it to our thoroughfares. As, by the common practice, Broadway would seem totally unfit for road-making, many dollars might be annually saved to the city treasury, and the wayfarers of that over-crowded artery gratefully relieved of the danger and inconvenience of traveling in omnibuses, by the novel plan set forth above. The road should be constructed of good solid plank, elevated about fifteen feet to admit the passage of the tall turn-outs of the upper ten,—the only turn-outs on the road,—without knocking off the hats of the drivers and footmen; supported in the centre of the street by locust uprights, which are very durable. Along this elevated plane a double stream of cars might fly with the velocity of a lie on the Magnetic Telegraph wires and without any very great danger to those cautious pedestrians who may take the side-walks. Depots might be established at suitable distances—say one at Trinity and the other at Grace Church, thus uniting the two extremes of Broadway in commerce and piety. A star policeman should be stationed at each end to see that the exercises are not disturbed, and now and then to look into Wall street. By this plan, the inhabitants of the upper Wards might just step into Grace Church and hear the singing and arrive at Trinity time enough to hear the text; and after dozing through the sermon, return to Grace in time for the last voluntary. The Magnetic Wires might also be elevated on the plane of the Rail Road, and thus rid Broadway of that picturesque absurdity.

THE FIRST PROPOSED ELEVATED RAILROAD FOR NEW YORK.

THE TRAMWAYS OF LAUSANNE.

The idea of the installation of tramways at Lausanne dates back to 1869-1872, that is to say, to the establishment of the Lausanne-Ouchy et Lausanne-Echalleus lines. The honor of it is due to Mr. Gossin, cantonal engineer. The system thought of then was that of Mr. Mekarski, which consisted in the actuating of automobile cars by compressed air. In 1882, Mr. Bergaron, another engineer, thought of exploiting a cable tramway of the Hallidie type in use in San Francisco, not only to do service for Lausanne, but also to radiate in different directions. In 1888, Mr. Vautier was charged with the study of a project based upon the Abt rack and steam propulsion system. The huge size of the engines caused the committee that had proposed the idea to reject it, and the conclusion was reached that the only system admissible in a city like Lausanne was electricity.

In the first project of Engineer Palaz the motive power was to be borrowed from the waters of the Bret, and the generating works were to be established under one of the arches of the great bridge. But as the conditions of this would have been too onerous, it was transferred to the Pontaise, and the choice was limited to either petroleum motors or those using poor gas. Finally, on December 21, 1894, Mr. Palaz obtained from the Federal Assembly the concession of a system subdivided thus:

Urban system comprising the lines: Tour de Ville, L. E. Monsquines station, J. S. St. Francois station, Riponne-Pontaise, Ecole de Medecine-Chailly.

The system comprised also the Monsquines-Lutry line.

Electric propulsion by aerial conductor, contact trolley and return by rails, prevailed for reasons entirely peculiar to the city of Lausanne. Accumulators were rejected on account of the strong declivities. They would have given rise to considerable dead weight. Steam propulsion, too expensive with so broken a profile, would even have been impossible upon the Chailly and Pontaise sections. The advantage of electric propulsion, such as it has been conceived, is that it permits of the use of light rolling stock and satisfies the exigencies of an active circulation. The only serious motive, moreover, for not taking some other mode of propulsion into consideration was the newness of such systems as those working by compressed air, which, however, have been greatly improved, especially by Messrs. Popp and Conti. Then again, there was the matter of fashion, the majority of the Swiss tramways recently constructed being operated by electricity.

It was a question of finding a source of electric energy. Should the hydraulic power of the Jura or Alps be utilized at Lausanne, or should a special generating works be created for the tramways? After long discussions, the latter was the solution adopted. The works decided upon consist of two parts: one of them, fronting upon Saint Martin Street, is 56 feet square, 26 feet in height, and contains the engines, dynamos and regulating apparatus. Its frame is metallic, and a fifty foot rolling bridge of five tons power is arranged in it. The other measures 41 × 37 feet and contains space for three gas generators and accessories. The accumulator room, which is 42 feet in length, 41 in width and 11½ in height, adjoins that of the gas generators. The apparatus for refrigerating the water and cooling the motors are placed at the extremity of the engine room in an annex reserved for them.

The motor using poor gas had the preference. It is supplied by a special gas produced at the works by blowing a mixture of superheated steam and air into what are called gas-generating furnaces. In this way a minimum expense of two ounces of anthracite per horse hour in current service has been reached.

At first there will be installed but two gas generators and two 130 horse power motors, one of which, represented in our engraving, will run, upon an average, from 18 to 20 hours a day. A battery of accumulators, serving as regulator and reserve, will be of about 200 horse power.

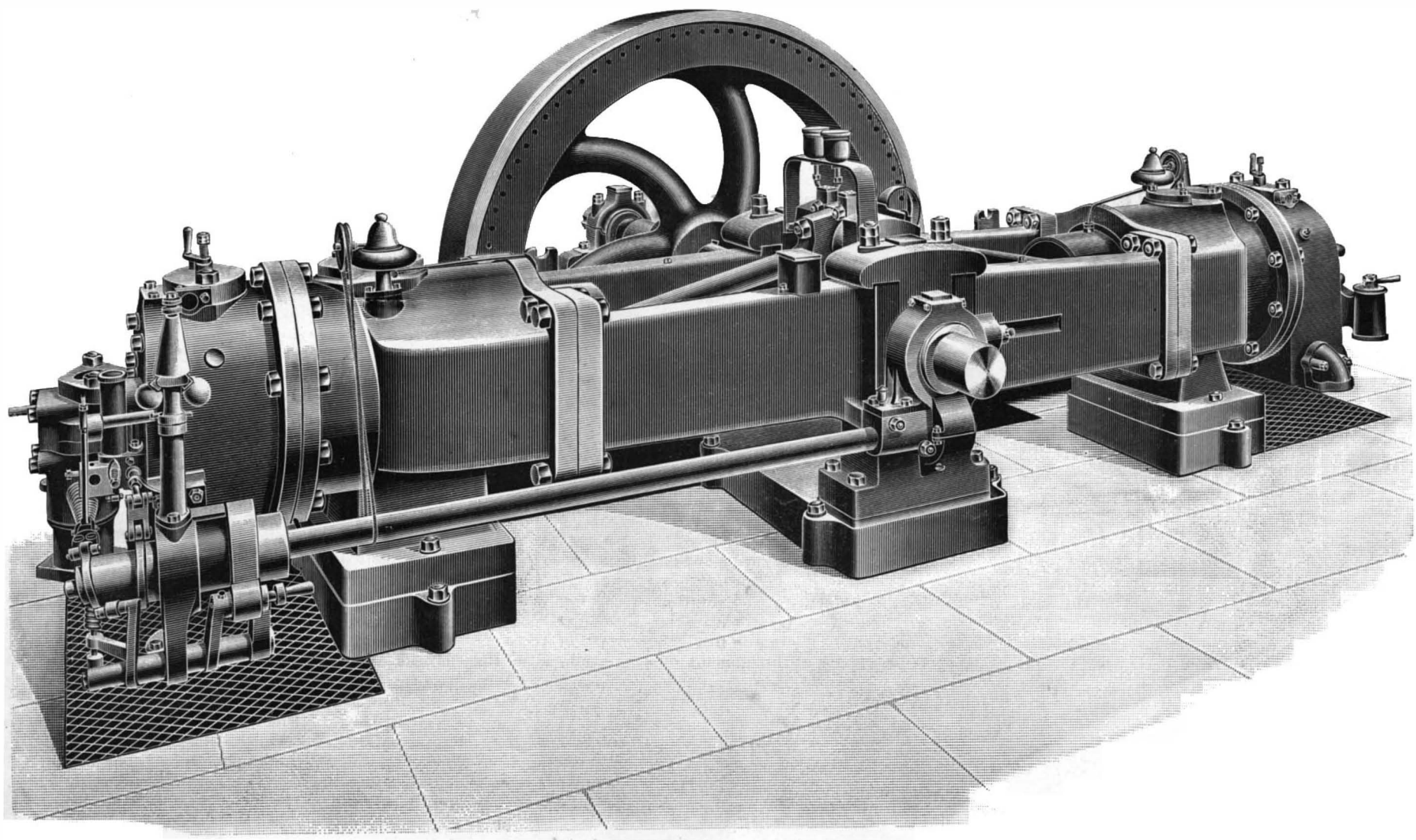
The track, which is of 3·28 foot gage, will be formed of Phenix 32 pound rails, laid upon 16 pound metallic ties in the unpaved portions and of 47 pound Phenix rails laid upon ballast and cross-braced in the paved portions.

The feed lines are now subterranean and now aerial. Those of contact are supported by poles or stretching cables.

The car has a capacity for 30 passengers. It is actuated by two electric motors of 20 horse power each, that drive the axle through a single train of gear wheels. It is provided with block brakes, electric brakes, and safety drag brakes acting upon the rails.

The 39 × 105 foot car houses will receive 20 cars.

The cost of the first establishment, which is doubt-



130 HORSE POWER MOTOR USING POOR GAS—CONSTRUCTED FOR THE CENTRAL STATION OF THE LAUSANNE TRAMWAYS.

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less quite high, as a consequence of the topography of the city, is thus distributed:

Land and outbuildings	$44,000
Generating works	54,000
Track and electric railway	73,000
Rolling stock	45,000
Administration, etc	30,000
General total	$246,000

As for the service, that will be 8 or 16 minutes, according to the lines.

As expense of motive power, one reckons about 2 cents per mile car, and an output of about two and a half pounds of anthracite per same unit.

For the water supply, a reservoir of from 2,880 to 3,600 cubic feet is proposed, and a double intake of water from the city mains and the Bret, the washing of the gas and the cooling of the motors requiring quite a large quantity of water.—La Revue Technique.

ELECTRIC IGNITERS FOR GAS ENGINES.

BY GEORGE M. HOPKINS.

Gas, gasoline and petroleum oil engines are daily becoming more popular, and not only is the number of regular manufacturers becoming very large, but many amateurs are trying their hands at the production of engines of this class. The field is very fascinating to mechanics, but no one knows the amount of experiment required, or the vexation experienced in bringing out a motor of this class, who has not already experimented in this line.

One of the most difficult problems is that of providing an efficient means of igniting the explosive charge in the cylinder at the proper instant without intermissions or failures. A red hot tube into which the gas is admitted at the right moment is simple, good and reliable, so long as the tube lasts, but the tube speedily burns out and requires renewal. Ignition by means of a traveling flame necessitates intricate and delicate devices which require constant care to prevent failure.

The electric spark, taken all in all, is probably the best igniter, but even that has its objections. It is largely used and is simple. As many amateurs are seeking information on the subject of ignition for gas engines, we have prepared illustrations showing the principle of the electric igniter, leaving it to the engine builder to make the adaptation to the particular engine to which it is to be applied.

The essential feature of the electrical igniter is the spark coil. This does not differ from the spark coil used in connection with an ordinary illuminating gas burner, and the electric lighting attachment to the gas burner embodies the principle of the igniter for gas engines, but it does not possess the required stability and lasting quality. The smallest practical coil is made by filling a paper mailing tube 7 inches long and 1⅜ inches in diameter with annealed iron wires of any size from No. 16 to No. 9, the wires being arranged in three or four layers around a ⅜ wooden core. Upon the paper tube are wound four layers of No. 16 cotton-covered magnet wire. Before winding the coil, wooden heads are secured to the ends of the core, as shown, to form a spool. The inner and outer terminals of the coil are connected with binding posts projecting from one of the heads.

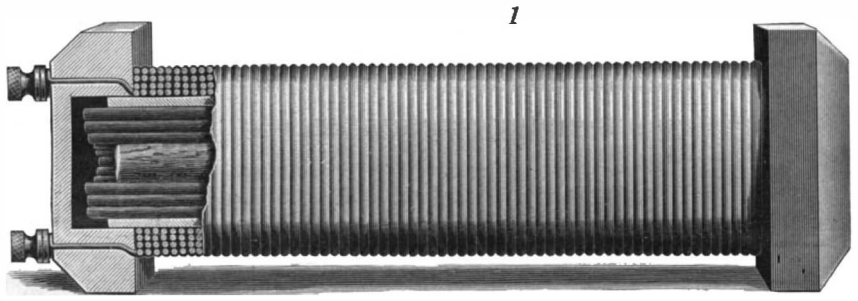


Fig. 1.—THE SPARK COIL.

The ratchet burner in connection with which the coil is intended to be used is shown in Fig. 2. The plug of the gas cock is provided with two transverse holes at right angles to each other, and the outer end of the plug carries a ratchet having eight teeth. On the shell of the gas cock is placed an angled lever carrying a spring-pressed hooked pawl, which engages the ratchet on the plug, and a spring is provided for returning the angled lever to the point of starting after it has been operated. By pulling the angled lever the plug of the cock is turned one-eighth of a revolution, so that the gas is turned on or off according to the position of the holes in the plug. To the upper end of the burner tube adjoining the tip is attached a collar which supports a wire contact near the slit of the burner. The collar is insulated from the burner by a piece of asbestos paper. The upper arm of the lever carries a spiral spring terminating in a wire contact arm which makes an electrical contact with the wire supported by the insulated collar whenever the angled lever is swung.

It will thus be seen that by swinging the lever the passage in the burner is alternately opened and closed. The collar at the top of the burner is connected with one pole of the battery and the burner or the bracket to which it is attached is connected with one terminal of the spark coil, the other terminal of the coil being connected with the remaining pole of the battery.

When the angled lever is pulled in the manner described so as to let on the gas, the spring arm at the upper end of the lever comes into contact with the wire supported by the collar, thus completing the electrical circuit through the coil and connections, causing the core of the coil to be strongly magnetized. The further movement of the angled lever draws the spring arm off from the wire contact supported by the collar, and at the breaking of the circuit the extra or induced current generated in the coil, being of very high potential, leaps across the space between the contact wires and produces a brilliant spark which ignites the gas issuing from the burner.

When it is desired to extinguish the light the angled lever is again pulled, revolving the plug of the cock ⅛ of a revolution, cutting of the gas supply. A spark is again produced at the points of contact, but this is of no consequence.

In Figs. 3 and 4 is shown the adaptation of this principle to the ignition of the explosive mixture in a gas engine. In the passage which admits the explosive mixture to the cylinder is inserted a hollow shaft the bore of which is eccentric, and in the shaft is inserted a spindle which is insulated from the shaft and carries at its inner end a finger piece which is capable of coming into contact with a stud projecting inwardly from the casing of the engine. The finger on the spindle is held in the proper position for contact with the projecting stud by a spiral spring surrounding the spindle and connected with the hollow shaft, but insulated therefrom. The hollow shaft is provided with a spur wheel by means of which it is turned, and the spindle extending through the hollow shaft is in electrical connection with one terminal of the spark coil, the other terminal being connected with the battery, the battery in turn being connected with the engine cylinder. When the hollow shaft is rotated in the direction indicated by the arrow in Fig. 4, the finger forms a contact with the projection, and the further rotation of the hollow shaft, by virtue of the eccentric arrangement of the spindle, causes the finger to slip from the projection and thus cause a spark at the moment of separation, as in the case of the electric gas burner. This construction permits of using heavy parts which do not readily wear out or burn out.

In Fig. 5 is shown a modification, in which the igniter is operated by reciprocating movement. The sliding rod to which is attached a contact piece is carried by a sleeve having an insulating lining. When the rod is drawn back the movable contact piece slips off from the stationary contact, as indicated in dotted lines, and a spark is produced, the arrangement of the circuit being the same as in the case just described. In this case, if the charge is not to be ignited at every revolution, a commutator or switch will be connected with the rotating parts of the engine which will intermit the current as may be desired.

There are many ways in which the making and breaking of the electric circuit in the chamber containing explosive mixture may be effected. The coil might have one, two or more additional layers of magnet wire. The main difficulty with this igniter is the failing of the battery. A battery consisting of four or six Fuller cells should operate the igniter for several weeks. Leclanche cells may be used, but they should be connected up so as to produce a quantity of current rather than high voltage.

A small dynamo has been used successfully for the ignition. In this case no spark coil is required, the extra spark from the machine itself being all that is necessary.

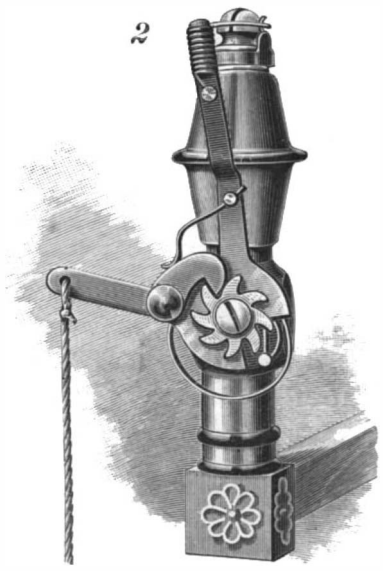
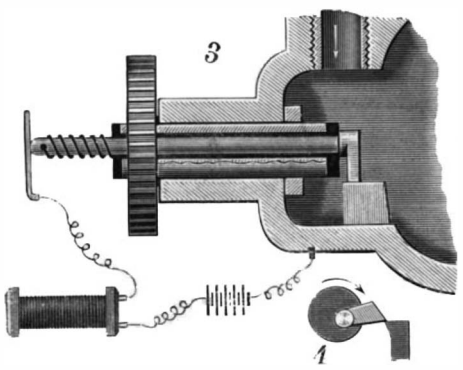


Fig. 2.—GAS BURNER WITH ELECTRIC IGNITER.



Figs. 3 and 4.—IGNITER FOR GAS ENGINE—REVOLVING FORM.

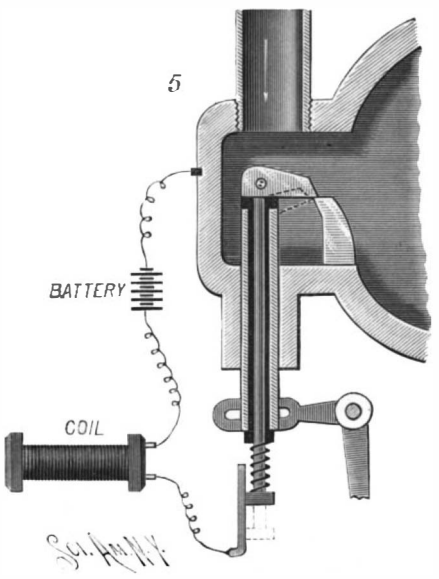


Fig. 5.—IGNITER FOR GAS ENGINES—RECIPROCATING FORM.

Japanese Demand for Cotton.

Regarding the recent heavy shipments of cotton from this country to Japan, Edward Atkinson, an authority on the cotton manufacture in New England, says: "There is no doubt that Japan will establish cotton spinning with considerable rapidity, and in the course of some years will probably be enabled to supply the increasing wants of the modern world, heretofore mainly supplied by England. But in order to make any of the fabrics which would have any considerable sale in this country merely as cotton fabrics, without regard to the design of the weaving or the printing, and in order to supply that part of the demand of China for what are known as gold end and red end shirtings, made of medium fine yarns, it will be impossible for Japan to use her own limited supplies of cotton or any of the cotton of China, which, although produced in very large quantities and admirably handled, is so short in staple as not to make it fit for the work, or even the India cotton, which is only fit for coarse, low numbers. Her whole supply of cotton must be found in this country. Hence it follows that the progress of Japan may to some extent check the demand for American cotton for English mills and may, at least, prevent the increase, if it does not work a reduction, in the export of cotton fabrics from Great Britain, but will have no influence whatever upon the cotton manufacturers of this country so far as the making of the fabric is concerned. What we have to fear, if there is anything to fear, in getting the goods which people desire, are the skill, taste, and aptitude of the Japanese in devising both woven and printed cotton fabrics. The influence of this demand upon the South will be very beneficial in hastening improvements in ginning, handling and baling, which have lately attained great prominence among the cotton growers of the South."

THE New York Carbide and Acetylene Company was incorporated at Albany December 24, to manufacture and sell gas-producing materials and acetylene gas, and to distribute other than by the use of mains, liquefied gas, and to manufacture and deal in gas apparatus in Milbrook, Dutchess County.

The capital is $7,000,000, divided into 70,000 shares. The directors are: E. C. Benedict, Anthony N. Brady, Edward N. Dickerson, J. Bertschmann, Charles F. Dietrich, Walton Ferguson, John Fox, R. Somers Hayes, Erasmus J. Jersmanowski, Frederick P. Olcott, Arthur B. Proal, John Sloane, and Samuel Thorne, of N. Y. City. Julius J. Suckert, of New York, subscribes for 69,988 shares of the capital stock of the company.

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The Causes of Death in Pneumonia.

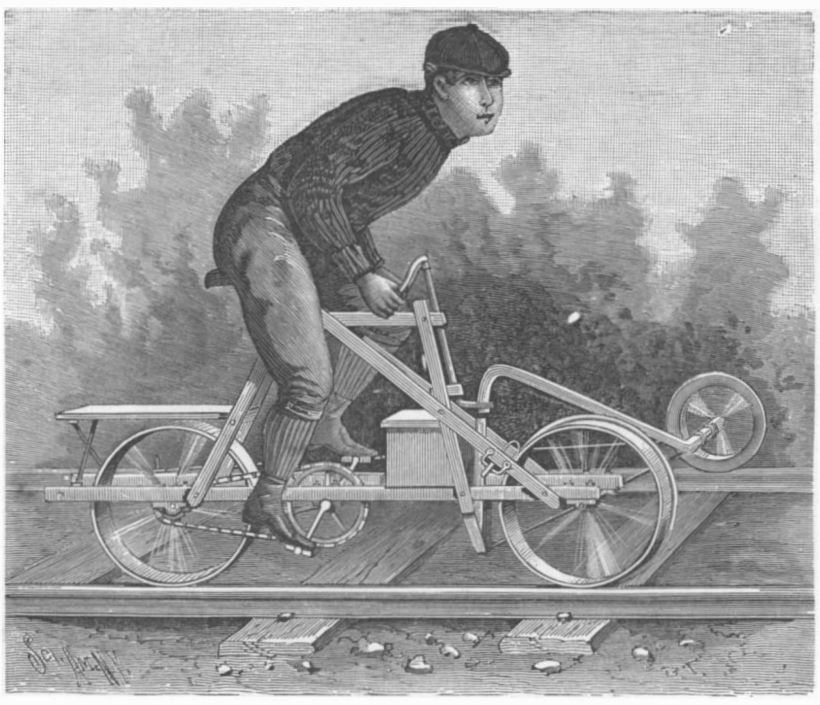
Dr. Bollinger maintains that croupous pneumonia is a typical local infectious disease, pursuing in the majority of cases a very regular course. It is not dangerous on account of the duration or the intensity of the fever. The impairment of the function of the lung is likewise insufficient to explain death. The œdema so frequently found in the parts of the lung spared by the disease is not the result of a passively increasing collateral hyperæmia, but of cardiac failure. The collapse symptoms in croupous pneumonia and the fatal weakening of the heart are dependent on oligæmia, which leads to impaired nutrition of the cardiac muscle, already weakened by the fever and the extra demands upon it. Anæmia of the brain may cause disturbances of innervation of the heart, and this may be an additional factor. The exudate into the lung tissue may be likened to a venesection produced by the pneumococcus, which in a few days deprives the blood of a large quantity of important constituents. The reason why death takes place so early, and usually in the same stage of the disease, from the sixth to the eight day (corresponding to the transition from red to gray hepatization), is probably because the exudate has to attain a certain acme before life is imperiled. If these facts are applied to therapeusis, it follows that, in addition to the usual treatment of pneumonia, every effort should be made to combat the oligæmia. Large quantities of fluids should be supplied to the system through every available channel, even in the form of saline infusions. This should be done at an early period, before collapse symptoms have manifested themselves.—Münchener medicinische Wochenschrift.

Uses for Old Corks.

Corks are thrown away in great quantities, and very few people think that there is any value attached to that material after it has served its purpose once as stopper of a bottle. Nevertheless it has become one of the most valuable components of a city's refuse. Great quantities of used corks are now used again in the manufacture of insulating covers of steam pipes and boilers, of ice boxes and ice houses and other points to be protected from the influence of heat. Powdered cork is very useful for filling in horse collars, and the very latest application of this material is the filling in of pneumatic tires with cork shavings. Mats for bathrooms are made of cork exclusively, and it also goes into the composition of linoleum. Cheap life preservers are now filled exclusively with bottle stoppers, cut into little pieces.

AN IMPROVED RAILWAY TRICYCLE.

The illustration represents a light, strong, and inexpensive tricycle, adapted to carry one or more persons, as well as tools and appliances for repairing electric lines and railway tracks. The improvement forms the subject of a patent issued to William J. Mellor, of Langtry, Texas. The front and rear main wheels are journaled in a frame, on which is a crank shaft and sprocket wheel to rotate the rear wheel. The other track rail is engaged by a flanged guide wheel on a short axle clipped to a transverse bar whose other end is bent to the form of a post and journaled in the middle portion of a U-shaped bracket attached to the frame. On the post is a collar engaged by an eye on a rod carrying the handle bar, the collar being adjustable to raise or lower the handles to suit the rider. From the lower end of the post a stiffening rod extends to an eye on the transverse rod, which is also further strengthened by a detachable brace rod, connecting it with the frame, but, by disconnecting the latter, the guide wheel may be folded upon the frame so that the machine will take up but little room, and may be conveniently moved about when not in use. A brake is arranged in the rear of the front wheel, and on the frame, in front of the sprocket wheel, is carried a tool box, a platform at the rear affording space for another passenger or for fixtures and appliances to be carried. By the movement of the handle bar the rider keeps the guide wheel in a proper forward or rearward position on curves, preventing any binding of the wheels, and readily balancing the frame where there is considerable difference in the elevation of the rails.



MELLOR'S RAILWAY TRICYCLE.

In the Boston Museum of Fine Arts there are many casts of works of sculpture which are dusted in a novel manner. A large air pump is mounted on a truck and is rolled around to the various rooms. One man operates this pump, the other applies a fine jet of air to the sculptures, blowing off the dust. This blowpipe is connected to the pump by means of a pole and rubber tube.

CYCLIST POLICEMEN IN NEW YORK CITY.

The introduction of the bicycle into municipal service has been tried in this city with excellent results. So far the introduction has been experimental, but the success of the service has been such that it will lead to a considerable extension in the near future. Police Commissioner Andrews, himself a wheelman, is made directly responsible for the innovation. Four policemen were mounted on bicycles, and assigned to duty in the upper part of the city. Already a number of meritorious arrests of reckless drivers and cyclists have been made by them. In the case of a driver the tactics followed are for the officer to ride ahead of the offending vehicle and allow himself margin enough for dismounting and making the arrest. In the case of a cyclist who was obdurate, the officer in one case ran into him, bringing wheels, officer, and cyclist down in a heap, but, as the commissioner expressed it, with "their man on top."

A NEW YORK CITY CYCLIST POLICEMAN.

The photograph shows one of the Boulevard police on duty. As the service is extended a special color or other designation will be adopted for the police wheels.

Commissioner Andrews told of one man who was recently promoted to the position of roundsman for meritorious arrests with the aid of the bicycle. Although a foot patrolman he impressed into his service on each occasion a private wheel, mounted it and caught his men, who, otherwise, on account of their long start, would infallibly have escaped.

The next move is to be the mounting of roundsmen on wheels. The duty of a roundsman involves the overseeing of a large district and the control of the patrolmen who are performing their tours therein. The bicycle mounted roundsman will, it is thought, be the ideal officer for this work.

For patrol work in the annexed district the cyclist policeman will be able to cover his round four or five times where the foot policeman would do so but once. In the case of an equestrian or mounted policeman the difference would probably be as great, as the horse is kept at a walk not exceeding a pedestrian in speed.

The Magical Mistletoe.

Few plants belonging to the English flora have associated with them so much that is of interest as the mistleoe, and the spoils of our orchards and of those of Normandy with which the markets are now crowded testify in no uncertain manner to the high estimation in which this remarkable plant is held by all classes of the community. Nor to those familiar with the traditions with which the mistletoe is surrounded is it surprising that it should be regarded with so much favor by rich and poor alike. The origin of the plant, about which a correspondent inquires was, according to tradition, an event of the most remarkable character, and it has had ascribed to it almost every conceivable virtue. We read in Norse mythology that Frigga, the mother of Baldr, the Apollo of the north, endeavored to preserve her son from harm by an oath from all, as she believed, created things, that they would not injure him. She, however, overlooked the mistletoe, "so small and feeble," that she did not take an oath from it. Loki, an evil spirit, discovering this omission, made an arrow of one of the branches and placed it in the hands of the blind god Hödr, who, throwing it at a venture, fatally wounded Baldr. The gods, however, restored him to Frigga, and, as some reparation, dedicated the plant to her, and gave her control over it for so long a time as it did not touch the earth. From this tradition has probably arisen the practice of suspending a bough from the ceiling and of persons saluting each other under it. The views held by some of the older herbalists and others with regard to the growth of the mistletoe are not less remarkable than the mythological account of its origin, and with reference to this Gerarde writes: "This excrescence hath not any roote, neither doth encrese himself of his seed as some have supposed; but it rather comethe of a certain moisture gathered together upon the boughs and joints of the trees, through the barke whereof this vaporous moisture proceeding bringith forthe mistletoe." We may, however, excuse Gerarde for writing what we now know to be nonsense, for before him Bacon treated with ridicule the views of those who contended that the plants were raised from seeds, and declared that they were produced by sap which "the tree doth excerne and cannot assimilate." As befits a plant with so remarkable an origin and manner of growth, the mistletoe had traditionally many virtues. The Druids attributed to it curative properties of a magical character, and, among other things, water in which a bunch had been dipped was distributed among the faithful as a talisman against witches and sorcerers.

Allusion is made to the magical properties of the mistletoe by Virgil, Ovid, and other old writers, one mentioning the power of opening locks. Clusius asserted that a spray worn as a charm round the neck was a sure protection from the evils associated with witchcraft, and another famous old herbalist, Matthiolius, declared it to be a certain cure for epilepsy, and it was held in considerable esteem as a remedy for that malady as late as the end of the eighteenth century. Since that time the mistletoe has fallen into disuse both as a charm or curative agent, and become popular for Christmas decorations, with the result that it now contributes more to the enjoyment of the Christmas season than at any other period in its history.—The Gardeners' Magazine.

THE year 1895 was the nine hundredth anniversary of the first appearance of the fork in western Europe, according to the Nazional Zeitung. In 995 a son of the Venetian Doge Pietro Orseolo married the Byzantine Princess Argila, who at the wedding breakfast brought out a silver fork and gold spoon. She was copied by the great Venetian families, though the Church opposed the fashion as an insult to Providence. It took 360 years for the fork to reach Florence; in 1379 it is found in France, but it was not till 1608 that "the traveller Corgate brought it direct from Venice to England."

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PRINCESS TOPAZE.

We publish herewith an engraving (for which we are indebted to our worthy contemporary the Illustrirte Zeitung) of Princess Topaze, a tiny dwarf, who was born of normal parents in the year 1879, in the neighborhood of Paris. We are told that the great capital in which she was brought up left its mark. She charms those who go to see her, not only by her attractive appearance—for although so small, she is perfectly formed—but also by her vivacity and intelligence. She has some skill as a prestidigitator and mind reader, to which accomplishments she adds those of singing charming little songs and dancing the serpentine and other dances. She is only about 23½ inches tall and weighs only 14 pounds. She has her own gala turnout, which resembles a perfectly appointed doll's carriage.

PRINCESS TOPAZE—AGE 17, HEIGHT TWO FEET, WEIGHT 14 POUNDS.

Wire Wound Guns Adopted in the British Service.

Successful trials of the high powered 12 inch 46 ton wire wound guns, with which the new British battleships of the Majestic class are being armed, has directed special attention to this system of construction for ordnance.

Between the years 1875 and 1879 several wire wound guns were made by the Armstrong firm at Elswick, the largest being a 10 inch gun, and the designs were even prepared for manufacturing 110 ton wire wound guns. In 1883 a 10 inch wire gun was made at Elswick, and shortly afterward experiments were carried out in France with wire guns. The form of the wire used in that country, however, was circular in section, instead of rectangular, such as is adopted for the government service in England.

Of the early experimental guns, however, little was known outside professional circles until, in 1884, a 9·2 inch gun was made at Woolwich, and exhaustively tried in the years 1887 and 1888 This is the piece which is commonly known as the Jubliee gun, because of a series of experiments carried out in the jubilee year of her Majesty's reign for the purpose of ascertaining its extreme range. It was fired at an elevation of 45 degrees, and the range was then nearly 22.000 yards, or 12½ miles, and at an elevation of 40 degrees the range was a little more than 20,000 yards. Two successive shots at this great range fell within 30 yards of each other.

Experiments were continued with great success until 1890, when the employment of the system in making British service guns may be said to have regularly commenced, according to information furnished the Boston Herald by Charles N. Robinson, Commander Royal Navy. It has thus been little more than five years in practice, but at the present time many hundreds of guns so constructed are actually in use in the British land and sea service. These guns vary in size from the 12 pounder gun of six hundred weight, used by the horse artillery, up to the 12 inch guns, weighing 46 tons each, with which the new battleships are now being armed.

The system of wire winding a gun is exceedingly simple. A tube, or barrel, of steel is surmounted by a layer of steel hoops, or in the case of the 12 inch gun, by one single loop. Over this hoop steel wire is wound, the number of successive layers of wire varying in different guns from 9 to 78 layers in depth. The wire, or ribbon, is rectangular in section, and is wound on the barrel of the piece at an average strain of about 40 tons to the square inch. The strain actually varies with each successive layer, being greatest with the first layer and least with the last layer. To wind the wire the gun is put into an ordinary lathe, the wire having previously been wound on a large drum. This drum is passed over an elevated shaft, working automatically with the lathe and controlled by a brake. One end of the wire is secured to the gun by being passed under a ring of metal and screwed down. The lathe then being turned around, the wire is wound off the drum on to the gun. It is to be noted that the wire is not wound directly on the barrel, or inner tube, but on the hooping which covers it, although in the case of the 12 inch gun this hooping takes the shape of a tube as long as the bore of the gun itself. The end of the wire is secured in the same way as at the beginning, with a ring of metal, and these rings are afterward turned down to the level of the last layer of wire.

On each of the 12 inch guns of the Majestic class there is wound no less than 102 miles of wire, the dimensions of the wire being 0·06 by 0·25 of an inch. When the winding is completed, a layer of hoops is shrunk on, so that externally there is no difference in appearance between the wire gun and an ordinary gun. There is no other gun in which the wire principle has been carried to such an extent as in the new 12 inch gun, on which the wire is wound from one end to the other. In the lighter guns it is wound only over the chamber and to a point about half way down the bore, to support the maximum pressures.

The time occupied in the process of manufacturing a 12 inch gun has recently been considerably lessened. Before the system of wire winding became the custom the construction of a heavy caliber gun occupied from 14 to 16 months, but the 12 inch guns for the new battleships have been made on an average in less than 11 months, and 10½ months is now looked upon as the ordinary time for the manufacture of one of these enormous pieces of ordnance. Of this period at least four to five months are taken up in the preliminary operations of turning, annealing, and testing the forging.

The wire winding process in the case of a 12 inch gun will take from six weeks to two months, and the process of rifling nearly as long. This last named operation is one which it is impossible to hurry, as only one man can be employed in the delicate work, for each groove of the rifling has to be done separately, and there are 48 grooves to be cut.

The advantage claimed for the wire system, theoretically, is that, by judiciously regulating the tension at which the various layers are wound, it is possible to make the whole of the material of the gun take up its proper share of the strain at the moment of firing, when the pressures in the bore are at a maximum. Practically, it gives great transverse strength, so that a burst seems almost impossible where it is used, and the tension to which the wire is subjected during its acceptance trials and at the time it is wound on the gun insures every portion of the material used in this form being thoroughly tested, so that there is no fear of hidden flaws.

It has been contended that a shot striking a wire wound gun might burst the covering jacket and cut several turns of wire. It has, however, been proved in practice that wire is not so susceptible to damage as might be supposed. It has been found that when it breaks during the winding it unwinds itself very little, the friction between the parts being so great. Moreover, great care is taken to secure the end of the wire after every few turns, so that the danger which might arise if several of the layers were cut is much reduced, since, although the outer layer might be damaged, the tension of those underneath would not be affected.

The reason for the adoption of the wire wound system lies, no doubt, chiefly in the introduction of cordite (smokeless powder) charges, and also in the belief that the time must soon arrive when shells charged with high explosives will be fired from heavy ordnance. The enormous transverse strength given by wire is a property which, under these circumstances, might be of very great value.

Primitive Man.

At a special meeting of the Anthropological Institute, held in London, November 25, Dr. Eugene Dubois, from Holland, read a paper describing his explorations in Java, and gave a demonstration of the interesting fossil remains discovered by him during six years' residence there. Most attention was attracted by the remains of a human-like femur, an anthropoid skull, and two molar teeth found alongside various extinct species in a Pliocene stratum on the banks of a river in Java. As these specimens were found within an area of fifteen meters, Dr. Dubois considers that they all belong to one skeleton. He holds that these form the strongest evidence yet adduced in favor of the doctrine of man's progressive development along with the apes from a common progenitor; for he asserts that these indicate a transitional and intermediary form between man and the anthropoid ape, a creature measuring about five feet and a half in height, maintaining an erect posture, to which he has given the name Pithecanthropus erectus. The individual bones have given rise to much discussion in the scientific world since Dr. Dubois published a short monograph some months ago describing the find, and on Monday evening he related the various divergent opinions held by authorities who have examined the specimens. The femur presents all the characteristics of a human thigh bone, and, strange to say, shows rare pathological changes, myositis ossificans having affected the insertions of muscles on the upper third of the shaft. Dr. Dubois, however, thinks that he discerns some distinctive features, especially in the popliteal surface: this triangular space between the divergent supra-condylar lines is seen to be convex instead of being flat as in the human bone. Some of the anatomical authorities hold that this appearance is the result of the pathological process.

Whatever difference of opinion exists regarding the femur, the skull is quite unique, and approaches more nearly the simian type than the famous Neanderthal skull, being much more ape-like in the sinciput, the supraorbital ridges being very prominent, with a marked flattening over the frontal bones; but, on the other hand, its larger cranial capacity of about 1,000 c. c. places it higher in the scale than any of the known anthropoid apes. The teeth, the distinguished lecturer maintained, belong to the skull and are very human-like in appearance, but the wearing away of the surface of the crowns points more toward the ape than to Homo sapiens. After the demonstration many distinguished zoologists and anatomists took part in the discussion, including Sir William Flower, Sir John Lubbock, Sir William Turner, Professor Thomson, Dr. Garson, Mr. Sutton, Dr. Keith, and others. If Dr. Dubois' thesis be adopted, that these specimens belong to the same individual, then we are bound to admit the existence at an early period of an ape more anthropoid, or a man more pithecoid, than any remains have hitherto revealed, thus constituting an important link in tracing man back to an early form, which probably existed in the Archipithecus in the Eocene or Pliocene periods, whence he became differentiated from the simians, gorillas, etc. If, on the other hand, the bones belong to two individuals, then we have evidence of man being contemporaneous with an ape at a very early period, having a skull more resembling his own in form and capacity than any now existing. The truly scientific attitude is to wait for further researches by the paleontologists before we attempt to formulate our opinions.—Lancet.

How to Walk Upstairs.

"There are but very few persons who know how to walk upstairs properly," says a well known physician. "Usually a person will tread on the ball of his foot in taking each step, springing himself up to the next step. This is very tiresome and wearing on the muscles, as it throws the entire suspended weight of the body on the muscles of the legs and feet. You should, in walking or climbing stairs, seek for the most equal distribution of the body's weight possible. In walking upstairs your feet should be placed squarely down on the step, heel and all, and then the work should be performed slowly and deliberately. In this way there is no strain upon any particular muscle, but each one is doing its duty in a natural manner. The man who goes upstairs with a springing step you may be sure is no philosopher, or, at least, his reasoning has not been directed to that subject."

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RECENTLY PATENTED INVENTIONS.

Mechanical.

NAIL PULLING HAMMER ATTACHMENT.—William A. and Frank S. Norton, Port Richmond, N. Y. A simple device for pulling long nails without bending them is provided by these inventors, as a readily applicable attachment to ordinary hammers, the device being easily removed from the hammer when it would interfere with other uses. It has an archshaped body, whose ends engage the outer side of the claw and heel portion of the hammer head, and is secured upon the hammer by arms at each side, the attachment giving greatly increased leverage for the purpose designed, as compared with the ordinary hammer.

GLASS REFLECTOR BLOWING MACHINE.—Lawrence H. Dolan, Alexandria, Ind. For blowing the glass reflectors used on oil and electric lamps and with gas jets, this inventor has devised a machine having a two-part mould adapted to shape accurately the reflector as it is blown, there being convenient means of continually moving the mould to prevent the glass from blurring, and also for raising and lowering the plunger which forms the lower part of the mould. The construction is designed to facilitate the much more rapid making of reflectors than has heretofore been possible.

EMBROIDERING MACHINE.-Alois Boehi, Newark, N. J. For elaborately embroidering the corners of handkerchiefs at low cost, this inventor provides a tambour frame having a series of individual holders in connection with a reciprocating needle carriage with a set of two needles arranged to move in the space between each two holders, the sets of needles being at distances apart corresponding to the distance between individual workholders. Double the number of stitches are thus produced than in the pattern, and a unitary design more elaborate than the pattern.

Agricultural.

FERTILIZER DISTRIBUTER.—Robert E. Carlton, Bethany, Ky. This is a hand-operated distributer in which two sections, each having a powder receptacle, are pivoted to each other, one receptacle containing the fertilizer and the other a white insoluble powder to mark the place where the fertilizer is deposited, the latter being deposited in the ground and the marking powder on the surface.

Miscellaneous.

BICYCLE HABIT.—Emma Dryfoos, New York City. This habit has a skirt-like body, divided at the back, while leg-forming portions have their front and rear lengths secured at their outer edges to the skirt body, the latter forming part of the leg portions. The habit is designed to have the exact appearance of a skirt and yet afford the wearer all the freedom of movement obtained with bloomers. It is also designed that a skirt of the ordinary type may be readily changed to the improved style, and a skirt-raising device is provided by which the skirt may be held at different heights when the habit is used as a riding habit or a walking habit.

BICYCLE SKIRT.—Thomas H. Royce, Brooklyn, N. Y. This is a garment designed to have all the advantages of a completely divided skirt or bloomers, while yet presenting the appearance of an ordinary or whole skirt. It is formed of two pieces of cloth, one of which is a duplicate of the other, and each division has at its inner rear side buttons and a strap, whereby the skirt may be held in more contracted form when the wearer is on a wheel, but will be returned to normal position when the wearer dismounts.

CONDENSER.—Arthur H. Squier, Scranton, Pa. This is an apparatus for removing moisture from gas, and comprises two sinuous pipes, one within the other, a vessel having a chamber in each of its ends, independent tubes connecting the chambers,. and one of the sinuous pipes communicating with one of the chambers while the other pipe communicates with the interior of the vessel between the end chambers. The inner pipe is connected with a gas supply and the other with a vessel for supplying it with a cooling medium.

FLOOD GATE.—Augustus C. Willis, Herald, Ill. This is a gate designed to be hung at its center, and with paddles having sharpened projections to assist driftwood in passing the gate. The gate has a sliding and pivotal movement in its supporting frame, and is adapted to be acted upon by the current, automatically regulating itself to the rise and fall of the water, means being also provided for holding the gate closed against the passage of stock at low water.

STRAP HOLDER FOR VEHICLES.—James M. Diffendafer, Churubusco, Ind. This invention relates to holdback straps to prevent vehicles running on the horses when stopping, the straps being usually secured to the tongues of the vehicle. On the under side of the tongue is a plate guide with serrated edges on which slides a strap holder of wire or metal with central looped portion adapted to receive the holdback strap, the strap holder being adjustable on the guide according to the size of the horse.

BALLOON.—Estanislao Caballero de los Olivos, New York City. This invention provides improved means for directing the course of balloons, a rudder being mounted to turn about an axis which intersects the vertical axis passing through the center of gravity of the balloon. The rudder is secured to a ring held to run on rollers journaled on hangers forming a circular runway, the hangers depending from a stationary ring concentric with the axis of the balloon.

SASH HOLDER.—Joseph J. Kelley, Great Falls, Montana. This device comprises a spring plate adapted for attachment at one of its ends, the other end having an adjusting arm by which the plate may be locked in a given position, while a roller journaled in the plate engages with the runway of the sash. The device is simple and inexpensive, and readily attached to a window sash, when it may be adjusted to engage the runway with the force requisite to hold the sash in desired position.

PICTURE CABINET.—Otto Messerschmitt, Milwaukee, Wis. This device comprises a cylindrical case with central vertical shaft, and within the case is a series of picture holding blocks adapted to swing around a common center, there being a lever connected with the central shaft to separately move the blocks. The invention provides a neat and artistic picture holder, for the separate display of successive pictures to be seen through an opening closed by a door.

FOOT BRUSH.—John Mellor, Aspen, Col. This is a brush designed for use as an ordinary foot wiper, and comprises a recessed base in which is mounted a brush having flat steel bristles and a rubber scraper, forming an effective means of quickly cleaning boots or shoes of mud, snow, dust, etc. It does not become easily clogged and has the combined action of a wiper and scraper.

DOOR CHECK.—Thomas Barnes, Rawlins, Wyoming. This device comprises a body portion removably attachable to the free edge of a door, and carrying oppositely movable floor engaging devices, there being rubber facings on the parts to prevent injury to the door or floor, and to secure a good hold of the check on the door and floor when in use. The device may be readily removed from the door and hung up near by for use when desired.

LINK BUTTON.—Edward B. Aiguier, Newark, N. J. This device consists of two buttons and a pivotal connecting link, the pivots being arranged obliquely to one another to hold the buttons in a like position, or diagonally across the adjacent ends of the cuff.

FISH HOOKS.—Elliott H. Crane, Niles, Mich. Two patents have been granted this inventor for bait-holding hooks, in one of which a spring pin is formed integrally with the hook shank, preventing the bait from becoming detached, while the other patent provides for two integral hooks, a large impaling hook and a small bait-holding hook, the normal action of the small bait fish being but slightly obstructed, so that it will live a long time.

DRIP CUP FOR BOTTLES.—James M. Howard, Newberne, N. C. This is a shallow cup with upwardly curved spring fingers adapted to clasp the sides of the bottle at the bottom, and hold the cup thereon in position to receive any drip which may run down when pouring out the contents of the bottle.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

POOR'S DIRECTORY OF RAILWAY OFFICIALS. 1895. New York: H. V. & H. W. Poor. Pp. 700. Price $8.

This is the tenth annual issue of a volume which has become invaluable to all who have business to transact with the several railroads of the country, either in the way of selling supplies, negotiations as to traffic, the introduction of new and patented improvements, or the financing of new or old lines. It contains complete and catalogued lists of the officials of all steam, electric, cable and horse railways, and a comprehensive buyers' guide to the principal manufacturers and dealers in railway appliances and all other articles used by railway companies. It also has tables of dividends paid by traction and industrial corporations, and shows the times and places of annual meetings. Its information as to street railroads includes statistics of mileage, equipment. gage, weight and kind of rail, capitalization, etc., of all electric, cable, and horse roads, throwing important light on the many changes now going on in this class of enterprises. The total length of street railway lines is now, it appears, 13,176 miles, of which 409 miles are operated by steam dummies, 10,233 miles by electric power, 574 miles by cable, and 1,950 miles by animal traction. The equipment of these roads comprises 30,857 passenger cars, 12,563 motor cars, 2,607 dummies, and 45,353 horses.

ETIDORHPA; OR, THE END OF EARTH. By John Uri Lloyd. Cincinnati: Published by the author. Pp. xiii, 376. Price $4.

This is a richly printed, handsomely illustrated volume, quite unique in its character. It belongs neither to science nor romance, and yet has enough suggestions of both to show that its author has dreamed of rather than labored with many problems of large interest, and prefers to treat in decidedly eccentric rather than the usual conventional style. Perhaps the main idea of the book is a warning against intemperance and inebriety.

CATALOGUE OF THE METROPOLITAN ELECTRIC COMPANY. Illustrated catalogue No. 3 of electric light, telephone, telegraph, fire alarm and house goods supplies, September, 1895. Chicago, Ill.: Metropolitan Electric Company, 186, 188 Fifth Avenue. Quarto. Pp. 755. Profusely illustrated.

This catalogue contains many hundreds of illustrations of electrical equipments and supplies of all kinds, and is a fine example of the modern trade catalogue. It contains a number of interesting rules and tables.

ALUMINUM. Its History, Occurrence, Properties, Metallurgy and Applications, including its Alloys. By Joseph W. Richards. Third edition, revised and enlarged. Philadelphia: Henry Carey Baird. 1896. 8vo. Pp. 666. 46 engravings. Price $6.

Ten years ago, aluminum was an almost unknown metal. It then sold for $12 a pound, now it is bought for 50 cents. Then the yearly production was less than is the present daily output. At that time the literature on the subject was very limited. The classic works of Tissier, Uhlenhuth, and Deville had only appeared. There are now eight works devoted to the subject and two journals, the Aluminum World, New York, and L'Aluminium, published in Paris. The lowering of the price of aluminum and the increased production has brought to pass the dream of Deville, for it is now truly become a metal of everyday life. The work of Professor Richards, of Lehigh University, first appeared in 1887, and was the first treatise on the metal in the English language, and for that matter is still so to-day. Various improvements in metallurgical processes made it necessary to revise the work to date, and several chapters have been largely rewritten. The sections devoted to the occurrence of aluminum and the physical and chemical properties are of particular value. That part devoted to metallurgical processes is very complete. On the whole the work is monumental, and is worthy of the splendid industry which it represents.

AGRICULTURAL CALENDAR FOR 1896. Reference book for farmers. By F. W. Woll, New York: John Wiley & Sons. 1896. 18mo. Pp. 305. Price $1.

DAIRY CALENDAR FOR 1896. A reference book for dairymen, butter and cheese makers. By F. W. Woll. New York: John Wiley & Sons. 1896. 18mo. Pp. 319. Price $1.

These volumes are now published for the second time. They consist of a calendar and diary for the year, pages for memoranda and cash accounts and a large amount of information of great value to the agriculturist and dairy man, including out-of-the-way information of the utmost importance to those engaged in these pursuits, such as a list of the agricultural experimental stations in the United States and Canada; lists of trade papers, etc. The works are of handy size and can be easily carried in the pocket.

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DER SCHUSS. Erklärung aller den Schusserfolg beeinflussenden Umstände und Zufälligkeiten. Auf Grund eigener Erfahrungen und mit Berücksichtigung der neuesten Fortschritte und Erfindungen. By Friedrich Brandeis. Vienna: A. Hartleben. 1895. 12mo Pp. 280. 44 illustrations. Price $1.

SCIENTIFIC AMERICAN BUILDING EDITION.

JANUARY, 1896.—(No. 123.)

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1. A residence at Orange, N. J. Two perspective elevations and floor plans, also an interior view. Approximate cost $12,000. Mr. Frank W. Beall, Chicago, Ill., architect. An imposing design, and one appropriate to the location.
2. A Colonial residence, at Springfield, Mass., recently erected for Mr. W. S. Scott. Two perspective elevations and floor plans. Cost $6,000 complete. Architect, Mr. G. W. Taylor, Boston, Mass. An artistic design.
3. A residence recently erected for Rev. S. E. Smith, at Corcoran Manor, Mount Vernon, N. Y. Perspective elevation and floor plans. Cost $7,500 complete. Mr. A. M. Jenks, Mount Vernon, N. Y., architect. An attractive design.
4. A dwelling at Hasbrouck Heights, N. J. Perspective elevation and floor plans. Cost complete $3,500. S. A. Dennis, Arlington, N. J., architect. A modern and attractive design.
5. Two perspective elevations and floor plans of a country house, at Lawrence Park, Bronxville, N. Y., recently erected at a cost of $10,000 complete. Mr. Wm. A. Bates, New York City, architect. One of the most artistic and picturesque country houses in Westchester County.
6. Public school No. 9, of Erie, Pa., recently erected at a cost of $38,000 complete. Mr. Joseph Frank, Erie, Pa., architect. The design combines a striking exterior appearance and a convenient interior arrangement.
7. A half-timbered cottage of moderate cost recently erected at Glen Ridge, N. J. Architect, Mr. E. R. Tilton, New York City. A pleasing design.
8. A view of the Washington Arch, New York City. Designed by Mr. Stanford White, of the architectural firm of Messrs. McKim, Mead & White, New York City.
9. View of the new Surety Building, New York City. Total height from curbstone to coping, 314 feet, being the loftiest inhabited building in the world.
10. Miscellaneous Contents: A great bell.—Calvert Vaux.—The world's tallest structures.—Powerful dredge for the Mississippi River.—The centenary of the Institute of France.—A new corner grate, illustrated.—The "American Trackless" sliding door hanger.—The Handco "straight flush" closet, illustrated.—A simple and efficient pump, illustrated. Staining wood.—Artificial fuel.—Ancient glass makers.—House numbering.—Fires in "sky scrapers."—Non-heat conducting coverings, illustrated.—Improved wood-working machinery, illustrated.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department. each must take his turn.
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Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(6691) H. R. S. writes: Will you please give a rule for calculating the diameter and height of brick stacks for boilers, that is, the diameter and height for so much grate surface or whichever the best way to put it? A. There is an old rule of thumb for chimneys, assigning one square foot of grate per horse power of the boiler, and from one-tenth to one-eighth the area of the grate for the area of the chimney, varying the height to make up for required draught. A more definite system of computing chimney power is in use by engineers, by which the quantity of coal to be consumed on the grate per hour and per square foot, with an allowance for the friction of the gases in the chimney, form the basis of the formulas for size and height of a chimney. A formula based on a consumption of 5 pounds of coal per square foot of grate per hour is much used, in which the horse power required and an assumed height of chimney are factors. Then

$$\frac{\text{Horse power}}{3{\cdot}33 \times \sqrt{\text{height}}} = \text{effective area},$$

which must be increased by its square root $\times 8$ for the actual area to allow for friction. In this way valuable tables of sizes and heights of chimneys for any horse power and for both brick and iron chimneys of round and square form have been made. See Kent's "Mechanical Engineer's Pocket Book," for valuable information and tables relative to chimneys, $5 by mail.

(6692) C. H. L. asks: Can you give me any information as to what causes a chimney to creosote, or what is a sure preventive? I have a chimney 40 feet long, 20 inches by 20 inches, but about two years ago I ran a wood furnace, and it is so bad now that I have got to stop my furnace. They told me to put a hood on the top of the chimney, and I did so, but I think it made it worse, if possible. I have tried all ways that I have heard of, and my last hope is that you will be able to tell me what it is and what causes it and what to do. I need it very much to run my fire to heat my house. The chimney is in a good locality and has a good draught. It soaks through the roof and drops down in my attic. I have been told that a chimney lined with tile would not creosote. Will it? If not, why? A. Some chimneys condense the creosote and smoke from wood fires. If your chimney is so situated as to be safe when burned out, it can be fired by building a sharp fire at the bottom. Otherwise it should be swept with a splint brush lowered from the top. The tile chimney is probably heated to a degree sufficient to drive off the creosote.

(6693) W. S. P. writes: 1. A week or two ago you spoke of there being no practical way to store up wind energy, suggesting that water might be pumped into a storage tank and a motor run from that. Why couldn't a weight be lifted by the wind and this weight be used to run a light machine like a dental engine or small polishing lathe, same as a tower clock is run by weights? A. The storage of wind power by pumping water into reservoirs, by lifting a large weight or by compressing air is practicable only on a small scale. The storage of electrical power is also feasible and in practice in a few places by wind power operating a small generator to charge a storage battery from which motors may be driven. This is probably the more economical method. 2. Which is the better for a hot water heating system, to leave the water in during the summer or draw it off? A. The water should be left in a hot water heating apparatus during the entire season when not in use.

(6694) J. C. writes: I have a fine bell weighing about two thousand pounds, which is cracked. I have been told by filing or sawing out the crack, the bell will have its original tone or nearly so. A. The tone of the bell can be restored on a lower pitch by drill-

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ing a hole ½ inch diameter at the end of the crack and sawing a kerf along the crack wide enough to prevent the edges from touching by the vibration of the bell. For the bell you describe the kerf should be ½ inch wide at the rim of the bell and narrower if convenient toward the hole.

(6695) G. G. C. asks us to explain the cause of sound in a steam whistle. A. The cause of sound in a steam whistle is the same as in any form of whistle or an organ pipe, viz.: A vibration of the atmosphere induced by a vibration set up in a steam jet directed against the edge of the bell, the vibration of the air or steam column in the bell influencing the tone according to its length and diameter.

(6696) Wm. N. C. asks the best way to cement a cellar floor 19 feet 8 inches by 26 feet 10 inches, the probable cost and which of the following suggestions is best if any are good: One suggested to me gravel for foundation and then a layer of cement. Another suggested broken brick or cobble stone pounded down for a foundation with cement between the pieces of stone or brick and then a layer of cement for the surface. Another suggested cement on the bare ground, then a layer of paving brick laid into the cement and on this another layer of cement. Also the quantity of sand and cement proportionately. A. If the cellar is liable to become very wet or have standing water, it should have a well rammed bed of concrete of broken stone or very coarse gravel, mixed with equal parts of cement mortar made with one part cement to two parts clean sand. When the concrete is set it should have a coat of cement mortar ¾ inch thick. The whole to be not less than 5 inches inches thick. If the cellar bottom is sandy and moderately moist, a thin coat of broken brick or stone rammed even with the cement mortar as above may be made with a half inch of cement plaster rubbed even with a trowel for a finish.

(6697) S. B. W. says: Will you inform me what is the best preparation and what is generally used to polish ivory and how to apply? Also the best preparation and methods for getting a high polish and finish on fine steel such as surgical instruments and dentists' tools when not nickeled. A. To Polish Ivory.—First use pumice stone and finish with putty powder; apply with a buff. To Polish Iron and Steel.—Usually the article to be polished is first rubbed down with emery of gradually increasing fineness, after which the article is moistened with alcohol or water and polished with Vienna lime, rouge or tin putty.

(6698) S. H. R. says. Will you publish a formula for a harmless color for the hair, producing medium chestnut? A. Where, from some personal idiosyncrasy, the color of the hair has disappeared and cannot be restored, a dye may be considered necessary, thefollowing will be of service; but the nitrate of silver dyes should be avoided, and the use of any dye for prolonged time is detrimental to the hair.

1. Brown:

Walnut skins beaten to a pulp	4 oz.
Rectified spirit	16 "

The above is perfectly innocent in its character.

The following is original, and non-injurious:

2. Black:

Sulphate of iron	10 grn.
Glycerine	1 oz.
Water	1 pt.

The hair must be thoroughly washed with this, dried and brushed once daily for three days; then the following should be applied on a small tooth comb, but it should not be allowed to touch the skin if the other preparation has done so, as a temporary stain would result.

3. Gallic acid 4 grn.
Tannic acid 4 grn.
Water 1½ oz.

After the first application of formula 2, the hair should be allowed to dry and then be brushed. Subsequently, both formulæ may be used once daily at an interval of an hour or so, until a black color is produced. All preparations of lead and mercury are injurious if used for any length of time; they may, however, be legitimately used where some small portion of hair has, from personal idiosyncrasy, lost its color, which cannot be restored.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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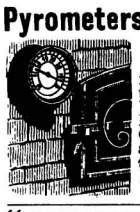

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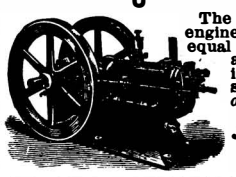

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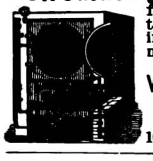

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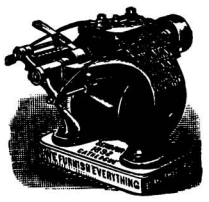

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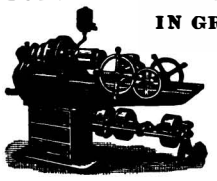

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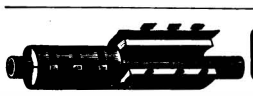

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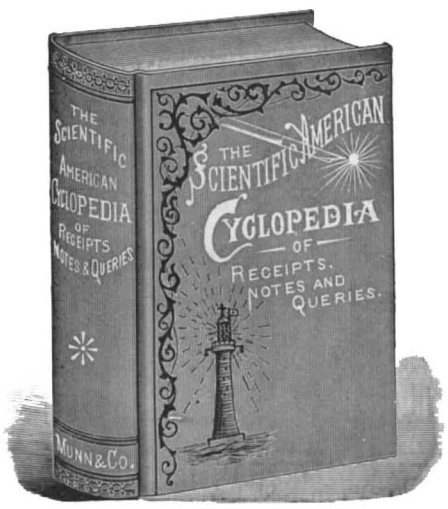

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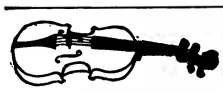

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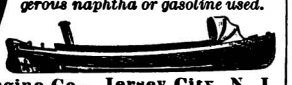

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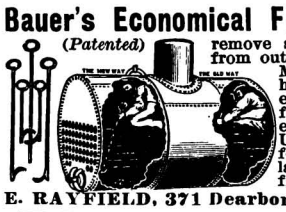

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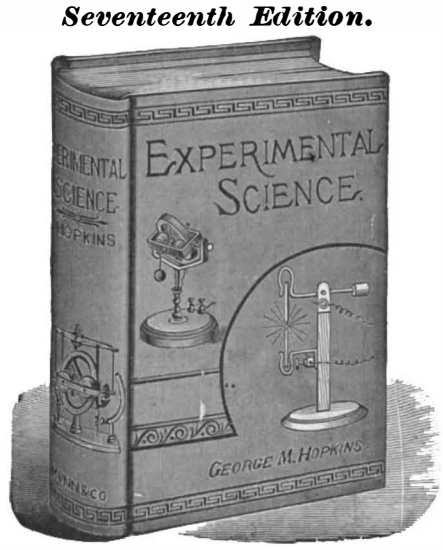

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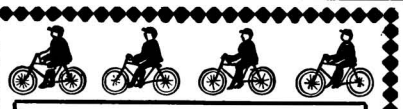

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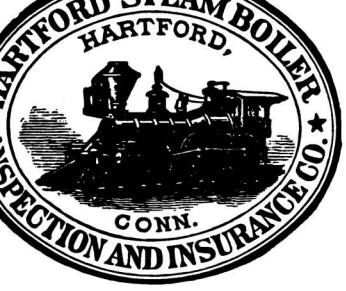

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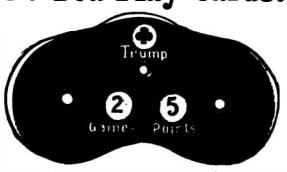

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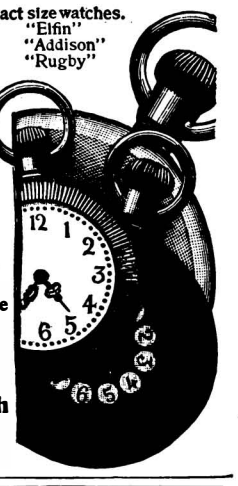

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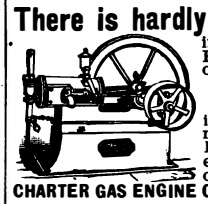

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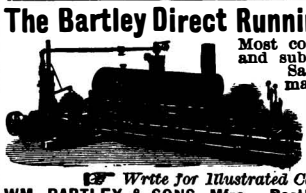

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